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Florida State Veterinary Medical Association Meeting

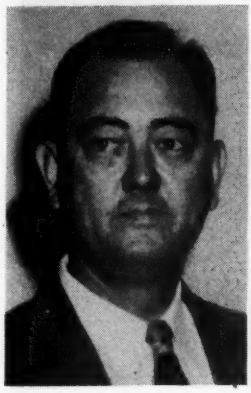
ON THIS and the following pages, the scientific program of the twentieth annual meeting of the Florida State Veterinary Medical Association, which was held in Jacksonville, October 23-25, 1949, is reproduced, so far as that is practicable, in type. Unfortunately, the laboratory demonstrations at the State Board of Health laboratories and a number of motion pictures, do not lend themselves to word pictures.

One of the latter, however, must be mentioned because of the marvelous clarity with which it demonstrated the action of the heart and operative procedures for correcting malfunction of this organ. This film, presented by Dr. Hiram E. Essex, Mayo Foundation, Rochester, Minnesota, was discussed in conjunction with his pager (page 85 to 87, this issue). It shows in great detail every movement of the heart and its parts in normal function and in slow motion. That part showing the opening and closing of the valves is on sound film enabling the audience to hear, as well as see, these phenomena with great distinctness.

Regrettably, because of illness, Dr. W. J. Gibbons, School of Veterinary Medicine, Alabama Polytechnic Institute, Auburn, was unable to present the discussion and film on Bovine Sterility which had been scheduled.

The social features of the meeting, which on this occasion were extraordinarily elaborate and pleasurable, are for the enjoyment of those who attend, not to be read about by those less fortunate, and this also applies to functions of the Women's Auxiliary, of which the Florida branch is one of the most active. Organized in 1947 with 20 members, it now has 100—a 400% growth in two years.

At this meeting, Dr. Paul Vickers, Tallahassee, was president and he was succeeded at the close of the last session by Dr. D. A. Sanders, University of Florida, Gainesville. Dr. C. E. Dee was selected as vice-president. Dr. V. L. Bruns, Williston, was re-elected secretary-treasurer and the dynamic Mrs. Bruns was re-elected to the same office in the Women's Auxiliary, of which Mrs. R. L. Brinkman, Live Oak, is the new president, succeeding Mrs. J. E. Scatterday, president of the past year. The hospitality hour and reception were held at the beautiful, riverfront home of Dr. and Mrs. P. S. Roy.



Dr. C. Paul Vickers

Dr. D. A. Sanders

Dr. C. E. Dee

Dr. C. P. Zepp, president of the A.V.M.A., was speaker at the banquet. He urged that clinical veterinary medicine be given more emphasis in veterinary college curricula and in practice and on no account should practitioners shirk their function of diagnosis onto the laboratory; the sole function of which is to supply the clinician with information. Application of the laboratory findings to the case in hand is the province of the practitioner. He deplored the fact that much of the veterinary research of the past has not been geared to the needs of clinical veterinary medicine. The banquet was followed by a floor show and a dance.

The first feature on the program was a demonstration of laboratory procedures in the State Board of Health laboratories,

which began on Sunday at 9 a.m. and lasted until 1 p.m. The large attendance at this session demonstrated even more fully the earnestness

Dr. V. L. Bruns

of the young veterinarians who comprise this young association, in their endeavor to increase their knowledge and improve their service to the livestock industry and to the public. The State Board of Health takes a keen interest in diseases communicable from animal to man and in veterinary medicine. In the main laboratories at Jacksonville, and the six branch laboratories over the state, there is an eagerness to supply veterinary practitioners with any sort of laboratory assistance they may require. This could hardly have been demonstrated more forcefully than by the willingness of some 20 key employees, under the leadership of Mrs. M. M. Galton, senior bacteriologist, to give up their Sunday forenoon, that the veterinarians might see the routine through which the specimens which they send to the laboratories pass. The load on the laboratory is so great that its operation could not be interrupted for this purpose on a weekday. In these demonstrations the laboratory personnel were assisted by J. E. Scatterday, public health veterinarian, and S. V. Ramsey and R. P. Knowles, Miami, practitioners.—D.M.C.

▼ ▼ ▼

Demonstrations by the Florida State Board of Health Laboratories

I. Colored slides showing the steps necessary in the laboratory diagnosis of rabies.

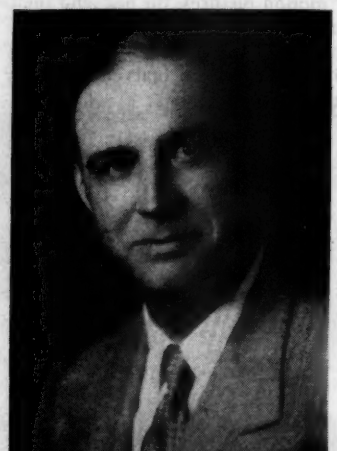
II. Colored slides showing the steps necessary in the laboratory diagnosis of enteric infections.

III. A discussion on the laboratory diagnosis of dog distemper by nasal inclusion bodies, by Vincent Saurino.

Tests Demonstrated.

I Milk
1. General bacteriological procedures
2. Brucella ring test
3. Bacteriology of mastitis
   a. Blood plates showing streptococci
   b. Stained smears of infected milk

II. Rabies
1. Negri bodies
2. Distemper inclusions
3. Mouse inclusions
4. Cat "bodies"
5. Rabid mice



Dr. C. P. Zepp

III. Dog Hookworms
1. *Ancylostoma braziliense*
2. *Ancylostoma caninum*

IV. Leptospira
1. Darkfield preparation showing culture of *Leptospira canicola*

V. Immunology
1. Rapid slide agglutination tests for brucellosis, tularemia and typhus
2. Hemagglutination-inhibition test for avian pneumoencephalites virus
3. Complement-fixation test

VI. Enteric infections
1. Plating media showing typical positive colonies of Salmonella and Shigella organisms
2. Screening tests, Kligler's iron agar, urea, indole and citrate media showing positive and negative reactions
3. Carbohydrate broths
4. Slide agglutination tests with polyvalent antisera

Diagnosis And Treatment Of Dysentery In Dogs*

JOHN E. CRAIGE, V.M.D., Seaside, California

THIS PAPER is supplementary to my paper on the same subject presented before the Section on Small Animals, 85th annual meeting, American Veterinary Medical Association, San Francisco, California, August 16-19, 1948, which has been published, (*Jour. Am. Vet. Med. Assn.*, 114:425 [June], 1949). In addition to the organisms covered in that report, three others are now considered to be important in the dysentery complex; a Spironema, a small Borrelia (spirochete) and trichomonads.

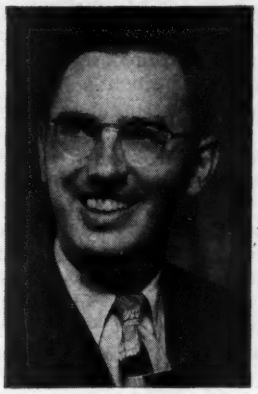
Spironema: The Spironema is the least important of the group. It is found in large numbers occasionally in cases of mild diarrhea but is also found in many apparently normal dogs. I feel that it is mildly pathogenic especially in puppies or if resistance is lowered. These Spironema respond to intestinal sulfonamides and penicillin like *Borrelia eurygyrata.*

Borrelia: The small Borrelia are minute organisms, about one-tenth the size of *Borrelia eurygyrata* and are found only by careful dark-field examination. They move with incredible speed, much quicker than any other organism I have ever encountered and can be identified only as flashes of light shooting through the darkened medium. They frequently move back and forth in a straight line at rapid speed. When caught standing still, either dead or nonmotile, they are found to be fine hair-like organisms not much thicker than a Giardia flagella with one to four spiral turns in the body.

These small spirochetes are capable of causing severe dysentery varying, as do other pathogens, with the age of the animal at the time of infection. Many older dogs harbor the infection without developing serious symptoms.

Animals infected with these small spirochetes have not responded to any of the regularly employed treatments for diarrhea. Streptomycin, penicillin, aureomycin or the sulfonamides have failed to control infection. Usually these microorganisms are not self-limiting but are continually discharged in the feces of infected animals for an indefinite period.

Before they were discovered, I observed a case of diarrhea with accompanying convulsions and found Borrelia and Proteus. The animal was treated with agents specifically directed to the control of these organisms, but little improvement followed. No other organisms were found, yet the dog failed to recover. An old man advised the owner to give the dog as much boraxo (soap) as he could get on the end of a knife blade. When the owner inquired about it, I told him to go ahead, since my treatment was not doing much good. Suprisingly enough the dog responded



Dr. John E. Craige

to this treatment; diarrhea and convulsions ceased. I lost the client, naturally, but when contacted about a month later by telephone, he advised that the dog still seemed normal.

Soon after this, these spirochetes were discovered and when every other treatment failed boraxo was tried. Results were very good but the animals vomited if large doses were given, and if the initial dose was too small they quickly developed a tolerance for boraxo and it was thereafter ineffective. A change to borax (sodium borate, U.S.P.) brought equally good results without the vomiting that occurred with the soap. No toxic disturbances have been observed from either boraxo or borax.

I consider this organism one of the most important pathogens in the intestinal group.

A Schnauzer bitch with an incurable infection with small spirochetes whelped under my supervision. No other intestinal infection was present, general condition was good and stools generally normal. Puppies were perfectly healthy and free of infection until two weeks of age, at which time a little diarrhea was noticed and small spirochetes found. No other

*Presented at the 20th annual meeting of the Florida State Veterinary Medical Association, Jacksonville, Oct. 23-25, 1949.

intestinal pathogens were demonstrated at any time during the course of the disease. Of nine puppies, all but two were dead within the first six weeks. One of these developed a severe chorea and had to be destroyed. The other is now nine months of age and apparently normal, having gone through ear cropping and distemper immunization without serious set-back. This puppy still is infected with the spirochetes and is subject to periodic attacks of diarrhea.

All of these puppies developed fits or chorea before they died. No elevation of temperature or upper respiratory infection was noted at any time. All received distemper serum at ten day intervals from six weeks of age. I feel certain that they did not have distemper and that the nervous symptoms were due to the small spirochete infection.

Many types of treatment for diarrhea were given to these puppies. Streptomycin was poured into them like water; penicillin injections were given regularly; sulfathalidine; tannin yeast; vioform and a preparation containing bismuth, kaolin and pectin were all used for sufficient time to determine their ineffectiveness. Borax was also given in large doses, but the organism had apparently become tolerant to that drug.

Trichomonads: Trichomonads have also been observed in several cases of diarrhea. They apparently cause only mild disease manifestations and are frequently self-limiting. However, they have been found as the only apparent pathogen in cases of chronic dysentery which cleared up upon treatment with vioform.

These protozoa are identified under the darkfield by their characteristic morphology and motility. They have an undulating membrane and several lashing flagella at one end.

Vioform, a Ciba preparation that liberates iodine in the intestinal tract, seems to be effective in sterilizing the feces of these organisms.

Pathogenesis

The pathogenesis of dysentery depends to a large extent upon the age of the animals. Puppies infected at birth or shortly afterward, may die within a few days of omphalitis and peritonitis in which Proteus is the only organism that can be recovered. We have not seen this syndrome with any other intestinal infection. Puppies infected at birth with spirochetes or protozoan pathogens may be apparently normal for a ten to 14 day incubation period, after which time they will break with a severe diarrhea mixed with blood and mucus. Animals so affected usually die within a few days unless treated.

As puppies become older they develop more resistance to the dysentery infections and the acuteness and severity depend upon a number of factors. Natural resistance to these organisms varies with the breed, strains within the breed, and individuals within the strain. Prenatal and postnatal care are very important in keeping up resistance, while parasites, internal and external, help to lower resistance. Another very important factor is the virulence of infecting organisms and the number introduced at the time of infection. The puppy may be able to withstand ingestion of a comparatively small number of these organisms but is more likely to succumb if large numbers of several different pathogens are taken in at one time.

Since the incubation period of the organisms varies, it is not uncommon to find and treat one infection such as Proteus, only to have the puppy relapse with another infection, usually spirochetes or Giardia, and again in a few days with coccidia. This is discouraging to the owner but if the possibility has been mentioned at the outset the owner usually does not become impatient, and if the treatment is carried out, each of the infections can be cleared up as it appears.

Most puppies which die of acute dysentery show some nervous involvement before death. Chewing fits in which the puppy salivates, works his jaws, stretches out in opisthotonus and finally goes into a running fit, are frequently encountered with Proteus, spirochetes (large and small), Giardia and coccidia. Chorea is another frequent symptom encountered in these cases. Litters have been observed in which some puppies died with fits, others with chorea, and still others, treated for the dysentery organisms found, recovered without nervous symptoms. The only symptom aside from fits and chorea was diarrhea; they did not have high temperatures nor upper respiratory involvement. It is felt certain that these cases were not distemper, but that the nervous disorders were caused by the dysentery infection.

Older puppies and mature dogs may develop chronic dysentery. General condition ranges from good to poor depending on the severity. The most predominant symptom is a stool that may vary from soft but formed, to a watery diarrhea, but that is never normal. These cases may go on for years with this condition without serious effects but such animals are not healthy and are constantly shedding the pathogenic organisms. Small Borrelia, *Borrelia eurygyrata,* Giardia and trichomonads

are the most common offenders in this type of disease but others are sometimes involved. These cases are often hard to clear up, requiring several examinations and courses of treatment since the organisms are deep seated in the intestinal mucosa. Animals can develop acute dysentery and die if concurrent bacterial or viral infection lowers resistance. At best they make unsatisfactory pets, since the condition makes housebreaking almost impossible.

Although mature dogs may develop acute dysentery and chronic dysentery, another syndrome is more frequently observed. This we have named chronic regional enteritis, since on autopsy only a small portion of the small intestine is found to be inflamed. This is typically caused by Proteus, but other organisms may be involved as secondary infections. Diarrhea is an inconstant symptom but often develops after some change in the feed or habits of the dog. For some unknown reason, milk in any form is not too well tolerated by any of the dysentery infections and tends to cause diarrhea in this syndrome.

Secondary symptoms are encountered in regional enteritis which do not appear to come from intestinal infection. Many cases have been treated in which the owner complained of poor coat, loss of weight, inappetence, listlessness, extreme nervousness (even hysteria and fits), blindness without visible ocular lesions, or other obscure symptoms, which have become perfectly normal after the intestinal infections were relieved.

A working theory has been developed on the pathogenesis of these secondary symptoms. The regional infection causes both abdominal pain and irritation. These, of course, may produce a variety of changes within the blood stream and nervous system, that in turn cause the obscure symptoms.

Although Proteus organisms have been found in apparently healthy dogs this infection has usually been fleeting and the organisms could not be isolated on subsequent examination. Prevalence of these organisms in nature makes it extremely likely that dogs will be exposed to them from time to time during their lives. However, the organisms apparently do not become established in the intestinal tract unless something lowers resistance to the invasion. I have never observed a persistent Proteus infection in which there were not some symptoms of disease; either occasional diarrhea or obscure symptoms, which were relieved when the infection was overcome.

Dr. John R. Gorham reported 100% infection with Proteus organisms, including a large percentage of normal dogs. It is probable that many of these so-called normal dogs actually were subject to attacks of diarrhea or showed obscure symptoms that might be referrable to regional enteritis. In a series of 250 dogs, selected at random, we found incidence of 40%. Before Gorham's 100% incidence can be accepted, the possibility of recent infection, as in a veterinary hospital, must be eliminated; in other words, the dog might have been placed in a contaminated kennel or picked up Proteus organisms as a temporary intestinal inhabitant from some other source in the hospital. It must be made clear that dogs were sampled from a wide segment of the dog population rather than from one small group which might show a higher incidence than normal. One hundred dogs could be taken from a certain kennel that will not be mentioned by name and 100% infection with Proteus, spirochetes, Giardia and coccidia found.

Treatment Recommended for Proteus Dysentery

Although streptomycin is specific for acute Proteus infection it is not entirely satisfactory in these cases since the symptoms recur as soon as the streptomycin is eliminated from the body and, after several courses of treatment, the organism becomes resistant to the streptomycin. In my hands, the most satisfactory treatment has been the use of autogenous bacterins.

Autogenous bacterins have been prepared and used on about 150 cases of chronic Proteus dysentery. About 95% of these cases have shown more or less improvement. Many of them were chronic cases that had made the rounds of several veterinarians before the bacterin was used and had regained normal health and remained normal afterward, some as long as two years. The few which died during the course of treatment, it is felt, would have died anyway. In a few cases the bacterin failed to eliminate the organism from the stool although it did cause some improvement in the general condition. There were no serious reactions to the bacterin therapy.

Although no antigenicity studies have been made with these organisms, it is probable that they have a complex antigenic structure similar to the Salmonella group. Heterogenous bacterins were tried without success on several cases where the owner could not afford to have an autogenous bacterin prepared. Recently, six known effective bacterins were combined and used in these cases. The results seem to be better with this mixed bacterin. It is

earnestly hoped that some biological company will investigate this problem and will produce a mixed Proteus bacterin which will be effective in a large percentage of cases, eliminating the hazard of autogenous bacterins.

Management of Intestinal Infections

It is extremely important that the practicing veterinarian understand and sympathize with professional dog people. Admittedly, these people seldom bring their animals to the veterinarian, even if they can afford to, since so many of them admit that they know more than any veterinary practitioner. However, a conscientious veterinarian can assist breeders and their recommendations to purchasers of puppies can be very valuable.

Although few of them will admit it, these dysentery organisms are a great problem to dog breeders. Many kennels are unable to raise a litter of healthy puppies; they all die of so-called distemper or some other disease. Those they do sell are a source of anxiety and expense to the new owners and embarrassment to the kennel operator who developes an aggressive attitude toward all veterinarians because they cannot cure the dogs. The kennel owner tries every known treatment and several unknown. Every accepted sanitary practice is scrupulously followed, yet the puppies continue to die.

The explanation for this lies in the fact that so many dogs are chronic or apparently healthy carriers. These dogs infect their own puppies which are susceptible. Those that do recover again become carriers and keep reinfecting all the other dogs in the kennel. Many of these dogs are used for breeding purposes and are shown, giving opportunity to spread the infection promiscuously to all susceptible animals.

My practice, of course, covers only central California. This condition is found in so many kennels that I consider it universal in that area. Since I have seen infected dogs imported from kennels from many other sections of the country, I am convinced that it is a universal condition, varying only from kennel to kennel, depending on the care taken of the dogs, and their natural resistance. For instance, severe manifestations of this disease are seldom seen among Dachshunds, although it is common among Setters, Pointers, Spaniels and Weimaraners, often from the same kennel. All breeds are susceptible but natural resistance protects some of them. Under exposure to massive infection or because of severe debilitation, a larger number are overcome.

Management of these intestinal disorders poses some difficult questions. An individually owned dog can be tested, his infections discovered and treated with a reasonable assurance of success. If the owner will cooperate by maintenance of strict isolation until the dog passes the most susceptible stage (one year), and if he will provide ordinary good care, the animal will probably be all right.

Such a procedure is not practicable in a large kennel. It is usually not economically sound to test and treat all the dogs, since some of them might be stubborn in responding or might relapse and reinfect all the dogs. Even though they were all cleared up at one time, reinfection is practically inevitable and the whole job must be repeated. We all realize that only the independently wealthy breeders can afford such a program, which is strongly recommended in those cases, but some method must be devised to allow the average breeder to raise puppies and sell them, with a minimum of disease.

The breeder should be made "bowel conscious." He should be taught that the dog's normal stool should be formed and firm enough that it will not stick to paper when it is picked up. He should consider anything else potentially dangerous especially if it persists for several stools. A complete check should be made of several representative dogs in the kennel and the kennel operator given complete instructions on the treatment of the known infected animals. Continuous supervision is advised to assure progress. In my experience, if my findings and treatment are carefully explained to the kennel operators, they are convinced that veterinary medicine is more complicated than they had thought and they are more likely to follow instructions and to ask for additional help when needed rather than to use their tried and untrue remedies.

The kennel operator thus has on hand medicine to treat the infections that are most likely to occur in his kennel. If this medicine fails to produce results, he is instructed to bring in a dog for another examination and the recommendations are based on the findings. Chronic carriers are frequently eliminated rather than making an attempt to cure them.

Parturient bitches are isolated about two weeks before whelping wherever possible and a test run on them. Puppies are also completely isolated from older dogs until they are sold or are at least six months of age and have had permanent distemper immunization.

This method of handling has been very successful with several breeding and boarding

kennels. Organisms, such as the small spirochetes, that are not controlled by present therapeutic methods, make favorable results impossible in all cases, but even in these cases an accurate prognosis can be made and the kennel operator can decide whether it is advisable to cull the carriers or try to get along with the infection.

The importance of these dysentery infections in dogs and cats is hard to overestimate. I have been extremely hesitant about attaching too much significance to them since I realize that all of us tend to stress the importance of the field in which we are most interested. However, after two years of critical clinical study of these infections I am convinced that they are the most important condition referred to the small animal practitioner. In one or another of their forms, they are found in about 75% of my medical cases. They cause serious secondary infections with distemper, leptospirosis and every other general infection, and are important disease entities of themselves.

The factors that make them so important are their chronicity and the habits of dogs. Most general infections run a course, after which the animal either dies or gets better but is no longer a source of infection.

Dysentery infections are not like this. They are seldom self-limiting and many cases that apparently recover shed the organisms for the remainder of their lives. Unfortunately, the eating and social habits of dogs cannot be considered hygienic. Instead of avoiding anything that might have fecal contamination, the dog's nose unerringly leads him to the most infective material. Unless this can be explained to the dogs and a change in these habits brought about, this condition is going to get worse, if possible, until the veterinary profession devises some means to combat intestinal infections.

Two methods of attack present themselves. (1) The technic described in these papers can be followed and as many dogs as possible cured, and (2) only dogs showing a natural resistance should be bred, thus obtaining relatively resistant strains of animals.

I do not consider that this work is by any means complete or even completely accurate. However, until research gives us a more thorough and accurate understanding of the subject, this approach may offer the practitioner a reasonable explanation of and a highly effective method of handling some of the difficult intestinal infections.

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A large number of diseases of the dog are characterized or complicated by symptoms involving the digestive tract.

Vitamin B_{12} in Animal Nutrition*

A number of excellent papers concerning preliminary experimental results in the use of vitamin B_{12} in animal nutrition were presented at the meeting of the American Society of Animal Production held in Chicago, November 25-26, 1949.

In early trials at the University of Missouri by Anderson and Hogan, a basal corn-soybean ration was fed to three groups of weanling pigs; one received the basal ration alone and the second and third, basal ration supplemented with 10 micrograms per pound of feed and an adequate fish meal supplement respectively. Average daily gain reported for the basal group was 0.86 lb.; vitamin B_{12} group, 1.14 lb., and fish meal group, 1.36 lb.

Cunha, *et al.*, University of Florida, reported that pigs weighing 18 to 33 pounds and fed for five to six weeks gained about 30% faster when the ration was supplemented with animal protein factor (APF), than their controls fed on the basal corn-soybean ration.

A practical and commonly employed ration for growing pigs, containing 70 pounds of yellow corn, 25 pounds of soybean oil meal, three pounds of alfalfa leaf meal, 1.5 pounds of pulverized limestone, and 0.5 pound of salt, was fed experimental lots of growing pigs as reported by Hale and Lyman at the Texas A. & M. College. To this basal ration was added 1.5 mg. of vitamin B_{12} per 100 pounds of feed. Pigs getting the B_{12} vitamin made 31% greater gains than did the pigs in the control group. Significant also was the fact demonstrated that the pigs on the B_{12} ration required 22.7 pounds less feed per 100 pounds of gain than did the pigs on the check ration.

In checking the possibility that cobalt deficiency in sheep may be due to a lack of vitamin B_{12} synthesis in the rumen, Hale, *et al.*, at the University of Wisconsin, fed rumen contents of cobalt deficient sheep to chickens. In five separate trials some growth factor(s) was shown to be missing from the rumen contents of cobalt-deficient sheep, which slow growth rate could be completely overcome by adding vitamin B_{12} to the ration allowed.

Lueche, McMillen and Thorp, at the Michigan State College, reported that at the end of the 11 weeks of trials those pigs receiving vitamin B_{12} made an average gain of 1.5 lb. per day and required 2.66 lb. of feed per pound of gain. A control group gained an average of 0.98 lb. per day and required 2.90 lb. of feed per pound of gain.

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Nasal Inclusion Bodies In Dog Distemper*

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IN THE active stages of dog distemper, definite inclusion bodies, comparable to Negri bodies in rabies, are present in the nasal mucosa—in the fixed tissue cells of the mucosa and also in the small migratory lymph cells which may be very numerous in nasal specimens taken in the first febrile period. Specimens from the nose, mouth and throat of dogs and other animals contain bacteria in large numbers and, usually, of many varying types. These make the detection of virus inclusion bodies uncertain and often impossible when the common bacterial stains are employed.

However, as described earlier by members of our laboratory, in certain respiratory infections of man, causing acute sore throats and chronic coughs, measles and scarlet fever, virus inclusion bodies may be given prominence by a differential stain, nigrosin, which shows less affinity for bacteria and tissue cells than for inclusion bodies.

The same differential staining values occur with distemper inclusion bodies, as shown by the affected cells in a specimen taken from a dog with a temperature of 105 F. during the first week of the attack. These cells show small but distinct bodies, which stain dead black with nigrosin, while the host cells are more or less grayish in appearance. They are most readily observed in the flat epithelial cells and the columnar cells, especially when they are otherwise normal in appearance. They are apparently not distinguishable outside the cells; if present in the disintegrated matter on the slides, they stain faintly, or not at all.

Procedure

Specimens may be taken with dry or slightly moistened swabs. For examination, a small amount of sterile water is pipetted into the swab tube and the swab is vigorously twisted and washed in the water. Smears for study may be made from the swab and from the wash water in the tube, using a pipette to lift out the heavier material settling to the bottom of the tube. If bodies are present they may usually be identified in either type of smear; the relative success with these two types of smears varies with the dried condition of the swab, the amount of mucus, etc. Swabs or water suspensions kept in the refrigerator apparently may be used successfully with nigrosin even two to three days after collection.

The smears are stained with nigrosin for 15 to 30 minutes. More than 40 minutes is undesirable as prolonged contact with the watery dye tends to remove too much of the material from the slide and overstains the tissue cells. Our present staining procedure follows:

1. Fix with heat, as usual.

2. Flood the slide with nigrosin (1.0% in water) for 15 to 30 minutes. (It is probably not necessary to add that the nigrosin stain should be filtered and autoclaved and stored in corked bottles. If not sterile, the bacteria in the nigrosin become black by the prolonged contact).

3. Using a pipette, replace the dye with water until no moving dye is observed; or slowly immerse the slide in a glass of water and as the dye begins to leave the slide lift it out gently. Drain dry.

4. Mount in balsam.

5. Examine with oil immersion lens; lower magnifications are not sufficient for these minute bodies.

These distemper inclusion bodies are commonly about one micron in diameter, though they range from one-half micron or less to about two microns. They are usually definitely cytoplasmic, often lying close to the periphery of the cell. An apparently nuclear position may be due to their being located in the cytoplasm directly over or under the nucleus, their exact position being difficult to ascertain in thin, flat epithelial cells.

Diagnosis of distemper by nigrosin or any other stain is somewhat complicated by the presence of small, slightly elongated, refractile, yellow to greenish brown organisms which were present in innumerable numbers in the throats of the 23 dogs we have examined. They commonly lie in masses on the epithelial

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*Presented at the 20th annual meeting of the Florida State Veterinary Medical Association, Jacksonville, Oct. 23-25, 1949.

**This work was done while the authors were at the Institute of Practical Science Research, Teachers College, Columbia University, New York, N.Y.

cells, though they may be sparingly present there or may be scattered loosely over a large area of disintegrating material. They maintain their yellow to green-brown appearance with the common stains and a careful observer would not confuse them with the distemper bodies; especially if full illumination (electric bulb) is used.

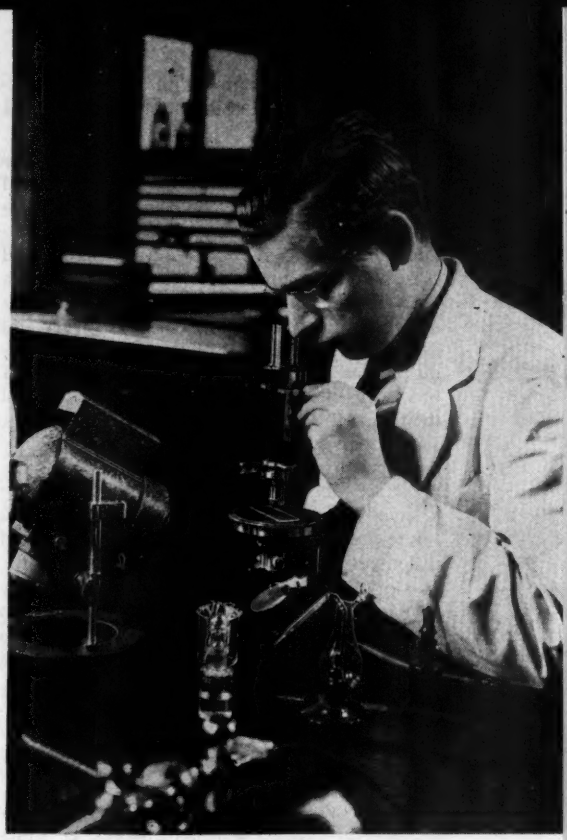
Some 25 decolorizing treatments have been tried but we have failed to obtain complete decolorization of these yellow to brown organisms without affecting the tissue cells, loosening too many of them from the slide, etc. A simple method of differentiating these yellow to green-brown organisms from the distemper inclusion bodies consists in making an unstained water mount with a cover glass for comparison with a nigrosin-stained slide of the same specimen. Once the two types of organisms have been identified, no further difficulty is experienced.

The distemper bodies here reported seem blacker and denser or "harder" than cytoplasmic bodies reported by our laboratory in human respiratory affections.

The distemper inclusion bodies have, however, several interesting characteristics in common with the inclusion bodies of the milder human affections: They are mainly, if not always, cytoplasmic; they sometimes lie on the periphery of the nucleus; the several bodies within a given cell are rarely of the same size and often vary greatly in size; and they do not cause the marked disintegration of the host cells which occurs with the measles virus in tissue cells.

Similar bodies may be observed in the blood, notably in the lymphocytes. The polymorphonuclear cells may be "shot to pieces" and in a blood smear dozens of fields may be examined without seeing one whole cell and it is difficult to be sure whether or not very suggestive bodies seen in the disintegrating polymorphonuclear cells are really inclusion bodies, particularly as nigrosin is not adapted to blood work. However, there is no doubt that small bodies, not normally present, may be observed in the lymphocytes. In the nasal specimens these lymphocyte bodies may be stained with nigrosin; but methylene blue stains them more readily in blood smears. How important these lymphocyte bodies may be in diagnosis we cannot prophesy at present; the nasal tissue cells seem much more favorable for this purpose, however.

There are six previous descriptions of inclusion bodies in distemper, reported by Lentz, Standfuss, Babes and Starcovici, Sinigaglia,



Sanfelice, and Lewy and Kantorowicz. Most of their reports were based on autopsy findings, chiefly in brain and spinal nerve cells. Sanfelice, however, included the nasal mucosa and the conjunctiva in his investigations. Except the bodies reported by Kantorowicz and Lewy, the bodies pictured or described by these six investigators are much larger than anything we have seen in our distemper dogs, being described by them as larger than Negri bodies, half the diameter of a red cell, two to 16 microns in diameter and, sometimes, larger than the nucleus of the host cell. The Lewy and Kantorowicz bodies differ from ours in showing distinct bipolar staining; those of Babes and Starcovici, Sinigaglia and Sanfelice contain definite inner bodies or vacuoles which our nasal bodies do not show. The huge nasal bodies of Sanfelice are not at all like our nasal bodies and it, therefore, seems as if the nasal inclusion bodies we have observed in ten dogs with distemper or a distemper history have not been previously recognized.

Carré transferred distemper to dogs by using filtrates of nasal secretions and the presence of inclusion bodies in the nasal mucosa is

certainly not at variance with the general acceptance of a virus as the etiological agent of distemper.

These nigrosin-staining inclusion bodies become infrequent in nasal smears as the animal recovers, though here and there in a microscope slide may be found single cells containing one to a few bodies several weeks and even several months after recovery. In human virus diseases, it is recognized that the virus may be present in the body after recovery and the occasional presence of these nigrosin-staining bodies in a recovered dog or in a dog of unknown history does not militate against their causal role in dog distemper. Their observed persistence helps explain the difficulty described by Dunkin and Laidlaw in breeding dogs free from distemper. Specimens from one litter of three, five-week-old pups, which were house-bred from a healthy mother who had distemper two years before, were negative for two of the pups and positive for one, a few scattered cells per slide containing one to three nigrosin-stained bodies. Since this pup has remained well for eight weeks since the examination and since pups are generally considered immune for four to six weeks following birth, this opens the question of the advisability of vaccination during this mother-transfer period of immunity.

Healthy dogs of unknown history often show a few, infrequent inclusion bodies in slides made from nasal smears. Occasionally, however, a negative dog is found which may be consistently negative. In our work a negative housebred pup about four months of age was continued under observation for three months. Examinations made on the average of two a week were negative throughout the whole period when the work was discontinued and the dog was given to a city neighbor who allowed it the freedom of the street. A month later the dog died with clinically typical distemper. There was no opportunity for microscopic examination during the illness or by autopsy but some interest, nevertheless, attaches to the susceptibility of this previously consistently negative dog. There arises immediately the question whether or not the presence of distemper inclusion bodies in well dogs may not be helpful in indicating the probable immunity of the dog to distemper—the presence of the bodies indicating past infection (recognized or unrecognized) or a resistant carrier condition. A dog positive by this test, and which does not develop distemper within a reasonable extension of the usual four-day incubation period, might well be considered immune to distemper, unless some unusually debilitating condition later should greatly lower its resistance.

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Radioisotopes in Veterinary Research

Studies to determine the effect on growth rate of English Bulldog puppies to mild hyperthyroidism, is reported by Borgman and Reincke (*Jour. Am. Vet. Med. Assn.*, 115:480 [Dec.], 1949).

Protamone, a commercial thyroprotein, was fed at the rate of 4 gm. per 100 lb. of dry matter. On the forty-eighth day of trial a dose of 2 cc. of radioactive iodine solution was given intravenously and counts taken over the thyroid gland region and extremities with a Geiger-Muller counter. By these methods it was possible to demonstrate a 24% reduction of the thyroid function of the pups receiving the protamone.

The authors conclude that the use of thyroprotein in growing pups of those breeds having a tendency to hypothyroidism could result in more robust individuals having greater disease resistance. Furthermore, it appears safe to feed small amounts of thyroid during the growth period in such animals without danger of hypothyroidism after thyroid feeding is stopped.

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Uterine Inertia in the Bitch

The employment of intravenous calcium gluconate (5 cc. of a 20% solution) is reported to have given good results in two cases of uterine inertia in which cesarean section appeared imminent†.

A Cocker Spaniel and a Dachshund bitch presented at full term and showing normal preparation for parturition, failed to make attempts to expel the fetus presented. Pituitrin injections were without results in the Cocker Spaniel and provoked the birth of one puppy in the case of the Dachshund. Intravenous administrations of calcium gluconate effected normal delivery of remaining fetuses.

The author concludes that the uterine atony may possibly be associated with hypocalcemia.

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Liver biopsy in human medicine is a recognized diagnostic step. A double needle is used during the brief period following a forced expiration—the latter so that the diaphragm is in a stabilized position.

†Barrett, E. P., A Preliminary Note on the Treatment of Uterine Inertia in the Bitch. *Vet. Rec.*, 61:783 (Nov. 19), 1949.

Shock: Its Production And Treatment*

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SPLENDID reviews of the extensive literature on shock are available to those interested. Neither the time nor the inclination exists for me to present a summary of the reviews on the subject. It is rather my purpose to give a brief account of certain of the investigations of the problem of shock in which I have participated. References also will be made to other reports that have a particular bearing on the subject being discussed.

For convenience, the material in this paper has been grouped under the following headings: (1) traumatic shock, (2) the toxemia theory, (3) hemorrhagic shock, and (4) shock resulting from the administration of drugs and other toxic agents.

Traumatic Shock

Our knowledge of all forms of shock has been obtained largely by experimental means. Traumatic shock may be induced under general anesthesia by trauma to large masses of muscle, such as the hind limbs, or by manipulating the small intestines. In our laboratory both methods have been employed but intestinal manipulation has been the procedure most frequently used.

The method, in brief, consists of exposing the intestines and running them through the gloved hands and fingers for a given length of time. In our work the intestines were thus manipulated initially for 30 minutes. They were then left exposed and were manipulated every 15 to 30 minutes until shock and death occurred.

It was recognized that anesthesia might be an important factor in experiments of this nature. Therefore, Seeley, Mann and I[1] studied the development of shock in dogs under ether and under sodium amytal (amobarbital sodium) anesthesia, as well as combinations of the two anesthetic agents. The mean blood pressure and the concentration of hemoglobin were observed. Shock was considered to be present when the mean blood pressure had decreased to and remained at 70 mm. of mercury or less. This state was reached in about four hours and death followed on the average about two hours later when ether alone was used as the anesthetic. When sodium amytal was used alone (50 mg. per kilogram of body weight) the critical level of the blood pressure was reached in about 11 hours and 30 minutes, with the death of the animal occurring about three hours later.

Samples of blood were tested for cell volume by the standard hematocrit method and for hemoglobin content with the Sheard-Sanford hemoglobinometer. After 30 minutes of ether anesthesia before the abdomen was opened, the average concentration of hemoglobin was 120.2% as compared with the control determinations which were arbitrarily taken as 100%. After shock had developed, the average concentration of hemoglobin was 130.3%. When sodium amytal was used alone as the anesthetic, the concentration of hemoglobin was 87.8% of the control value determined before anesthesia. At the time of shock the average concentration of hemoglobin was 137.7% of the control value.

It has been demonstrated in our laboratories by a series of studies[2] that the spleen of the dog is largely responsible for the initial reduction of the number of circulating erythrocytes. It was shown that the spleen under the influence of all the barbiturates thus far studied, removes large quantities of erythrocytes from the circulation. As the anesthesia subsides, the erythrocytes are returned to the circulation.

The enormous spleen observable in dogs after anesthesia with barbiturates has been noted by most laboratory workers. It might easily be thought to be owing to disease of the organ. That this interesting response of the spleen of the dog to anesthesia with barbiturates is important in delaying the onset of shock has not been shown by Kendrick and Uihlein[3] in our laboratory. It is conceivable that by emptying its large store of erythrocytes, the spleen gives, as it were, an autotransfusion and by so doing may retard the onset of shock.

Results similar to those with amytal anesthesia and ether anesthesia were obtained from studies done in our laboratories, by Kendrick[4], who compared the rate of development of shock in dogs under ether and under pentobarbital sodium anesthesia using methods similar to those already described. In the dogs anesthetized with ether, shock developed on the average in about four hours but in animals

*Presented at the 20th annual meeting of the Florida State Veterinary Medical Association, Jacksonville, Oct. 23-25, 1949.

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anesthetized with pentobarbital sodium nearly 13 hours were required for the development of these symptoms.

Beecher and co-workers[5] reported confirmation of our findings when shock was produced by intestinal manipulation in dogs under sodium amytal anesthesia, but they failed to obtain similar results when they produced shock by traumatizing limbs of animals under the influence of the same anesthetics. The anesthetic did not appear to influence the rate at which shock developed following trauma to limbs.

The possibility that the administration of oxygen to animals during the development of shock might be helpful in delaying the onset, and the death of the animal, was considered by Beecher and co-workers. The results of their experiments gave little support to the use of oxygen as a preventive or therapeutic measure.

Pender and I[6] did a series of experiments on shock produced by intestinal manipulation in dogs anesthetized with ether, pentobarbital sodium and pentothal sodium (thiopental sodium). These anesthetic agents were used with and without oxygen which was administered by the Lundy-Heidbrink gas machine. As in previous work, it was shown that shock and death followed most rapidly under ether, less rapidly under pentothal sodium and least rapidly under pentobarbital sodium anesthesia.

The inhalation of high concentrations of oxygen during the production of shock did not prolong the survival time except in those animals which had a low initial hemoglobin value. Our findings were in accord with those of Beecher and co-workers.

As an accompaniment of intestinal manipulation a considerable quantity of fluid appears on the surfaces of the intestines. It was thought that the loss of this fluid might be an important factor in the production of shock by intestinal trauma. Collections of the fluid led to the conclusion that the rate and amount of output of peritoneal exudate was an individual characteristic not closely related to the rate of concentration of hemoglobin or to the nature of the anesthetic agent employed.

The fact that premedication with sodium amytal had been instrumental in delaying the onset of shock produced under ether anesthesia stimulated our interest in testing several of the commonly used premedicants in this regard. Such a study was made with Anderson[7]. Morphine sulfate, atropine sulfate, pentobarbital sodium and various combinations of these drugs were used with ether anesthesia in dogs in which shock was produced by intestinal manipulation.

In brief, it was shown that atropine sulfate in doses similar to those used in man, was the most effective of all the premedicants in delaying the onset of shock and death in animals under ether anesthesia.

By utilizing the transparent chamber inserted into the ears of rabbits, Levinson and I[8] observed the behavior of the flow in the blood vessels during and after the development of shock resulting from intestinal manipulation. The animals were anesthetized with pentobarbital sodium. The average time required for shock to appear was about three hours, with death occurring about one hour later. The vessels in both innervated and denervated ears were observed. In the innervated ears the arterioles showed spasmodic constrictions and relaxation. As the experiment continued, the periods of relaxation became shorter and as shock developed there were times when the flow in the vessels of the chamber was completely arrested. In the denervated ears the same behavior was observed except that maximal constriction or complete cessation of blood flow was not observed. In both groups of animals, the functional capillaries diminished in number in proportion to the degree of constriction of the arterioles. There was not at any time evidence of capillary dilatation. It was quite evident that marked constriction of peripheral vessels occurred and that such behavior was not dependent on an intact nerve supply.

To summarize this phase of the discussion, it may be stated that barbiturates delay the onset of shock and death produced in dogs by manipulation of the intestine as compared to the results obtained with ether anesthesia. The marked alterations in the concentration of the erythrocytes in dogs under the influence of the barbiturates are owing to the effect of these drugs on the spleen, which under their influence may remove from the circulation as much as 20% of the hemoglobin. The administration of oxygen was not of great value in delaying shock and death. Premedication with atropine was definitely effective in delaying the appearance of shock when given with ether anesthesia. During shock produced in rabbits by intestinal manipulation, a vasoconstriction is seen that is not the result of nervous influences.

One of the most attractive theories ever advanced to account for shock resulting from various forms of tissue injury is the toxemia theory. The principal objection to this theory is that it has not had the support of positive experimental evidence. Kendrick, Helmholz

and I[9] attempted to test this theory by a series of experiments which we felt should be decisive.

The Toxemia Theory of Traumatic Shock

The hind limbs of dogs were perfused and the blood was given to recipent animals before and after the perfused limbs were hammered with a rawhide mallet. While 100 cc. of blood from the perfused limbs was being given to the recipient, an equal quantity was withdrawn, defibrinated, and added to the blood reservoir of the heart-lung-limb preparation. As many as 23 exchanges were made in certain experiments.

Blood from unaffected limbs or from limbs traumatized for short periods did not produce shock in the recipients as determined by the usual criteria. However, one recipient animal died eight hours and another 18 hours after the experiments were completed. Blood from limbs traumatized 35 to 40 minutes caused a significant decrease in blood pressure within 40 minutes after the first exchange of blood, and death occurred a few hours thereafter. It is highly significant that repeated removal, defibrination and reinjection of a dog's own blood was without effect on the blood pressure of the animal thus treated, and it fully recovered.

Even though we attempted to set up the experiments so that decisive results would be obtained it was necessary to conclude that only suggestive evidence for the toxemia theory of shock was found.

Shock Resulting from Hemorrhage

Reducing the blood volume by massive or by repeated small hemorrhages has been used by many investigators for producing shock. The blood may be withdrawn from an artery or from a vein under local or general anesthesia. The total volume of blood which may be removed before a marked decrease of blood pressure occurs varies within wide limits in the same species.

Ivy[10] has reported that a series of dogs under local anesthesia was allowed to bleed from a cannulated carotid artery until the flow ceased spontaneously. The final loss of total blood volume was from 45 to 67%, which occurred after seven to 20 minutes. It is surprising that 15% of the animals survived hemorrhages of this magnitude. Moon and co-workers[11] demonstrated that unanesthetized dogs tolerate twice as much hemorrhage as animals under amytal anesthesia. They stated that a loss of blood amounting to 9.1% of the body weight caused 77% hemodilution and death in 31½ hours without anesthesia, while half as great a loss of blood caused death in 31½ hours, the last 6½ hours of which the animal was under amytal anesthesia.

Roome and co-workers[12] reduced the blood pressure of dogs by nine different methods, among which were section of the spinal cord, spinal anesthesia, trauma to an extremity, and intestinal manipulation. The animals were bled to death after 60 minutes of lowered blood pressure and the volume of blood obtained was calculated in terms of the original estimated blood volume. They found that the average volume of blood obtained from animals whose blood pressure was lowered by section of the spinal cord or by spinal anesthesia was much greater than when the blood pressure had been lowered by hemorrhage, trauma to an extremity or intestinal manipulation. In a control series of experiments they compared the results of bleeding dogs under ether and barbital sodium anesthesia. The average percentage of blood removed before death occurred was respectively, 54.8 and 62.4. They concluded that the volume of circulating blood is not seriously diminished and consequently operation or loss of blood is well tolerated, in conditions of lowered blood pressure resulting from vasodilator mechanisms such as spinal anesthesia, administration of histamine and certain surgical procedures, but quite the contrary was the case when the blood pressure had been reduced by hemorrhage, trauma to an extremity, or intestinal manipulation.

In a series of experiments with dogs under ether anesthesia Mann, Herrick, Baldes and I[13], while observing the effect of hemorrhage on the flow of blood in certain blood vessels, withdrew slowly from the jugular vein as much as 60% of the estimated total blood volume before death occurred. The blood flow in the carotid artery was maintained at nearly the control level but the flow in the femoral artery was much more affected. In one instance when the blood flow in the femoral artery had decreased to about 50% of the control value, the animal had lost about 35% of the estimated total blood volume but even so there was sufficient cardiovascular compensation to maintain the blood pressure near the control level. With further withdrawal of blood, a physiologic blood pressure was maintained until only a few minutes before death when the blood pressure decreased suddenly to near zero and the animal died.

Price and co-workers[14] investigated the ef-

fects of acute hemorrhage in healthy dogs under pentobarbital sodium anesthesia. They concluded that progressive severe anoxia occurs as a result of massive hemorrhage. Initially, the vital centers did not share in the general lack of oxygen but probably did later. They did not find a relaxation of vasoconstriction nor did they observe congestion. They found that partially exsanguinated animals became extremely sensitive to further loss of blood and the removal of an additional few cubic centimeters resulted in immediate collapse. They stated that capillary atony did not appear and they did not see evidence of abnormal capillary permeability. According to their report, larger proportions of infused fluids such as isotonic saline solution, serum, or whole blood, leave the circulation of normal animals than they do after their administration to animals in shock from hemorrhage.

What has just been presented concerned animals which apparently were in good health. When dealing with animals in an admittedly poor state of health as the result of illness or injury, the volume of blood may be so reduced that a trifling hemorrhage may be sufficient to precipitate a severe state of shock and death unless proper measures are taken.

There is usually a tendency to minimize the amount of blood lost during an operation probably because of the fact that "a little blood looks like a lot." It must be emphasized that the important factor in the production of shock by hemorrhage is not the actual quantity of blood lost so much as the percentage of the circulating blood volume of the animal that is lost. When the disparity between circulating blood volume and vascular capacity becomes too great, death follows unless the blood volume is augmented by administration of fluids.

Shock Resulting from the Administration of Drugs and other Toxic Agents

There are many drugs, as well as other toxic materials, which when injected into animals cause the appearance of symptoms closely resembling those of traumatic shock and the action of certain others is indistinguishable from the effects of anaphylactic shock.

Epinephrine: It was thought at one time that traumatic shock was caused by an excessive outpouring of epinephrine into the circulation. In fact, shock was produced in dogs by injection of large doses of epinephrine over a period of an hour or more. The severe constriction caused by the drug is thought by Freeman to result in sufficient anoxia to destroy the vitality of the tissues.

Histamine: The possibility that the traumatized tissues liberated histamine or a toxic substance closely resembling this amine has been a popular theory. A profound state of shock can be caused in dogs, cats, rabbits and guinea pigs by injections of sufficiently large doses of histamine. Now that a number of antihistaminics are available, more decisive evidence on this question perhaps can be secured.

Snake Venoms: The venoms of most American snakes (pit vipers) are extremely effective in producing shock in all the mammals studied. Markowitz and I[15] showed that the shock in dogs resulting from injections of the venom of the rattlesnake (*Crotalus horridus*) was owing to peripheral vascular changes.

Extracts of Ascaris suum (*Ascaron*): It is now well established that intravenous injections of crude or purified extracts of the round worm of swine, *Ascaris suum*, and hydatid cystic fluid cause a profound state of shock in dogs, cats, rabbits and guinea pigs which is indistinguishable from anaphylactic shock. Grana, Mann and I[16] demonstrated that in the dog the liver was chiefly responsible for the extreme hypotension since liverless dogs were not seriously affected by doses of ascaron that killed intact animals. Thomas and I[17] showed by making casts of the hepatic vasculature that the hepatic veins were thrown into such intense spasm that passage of blood from the liver was prevented. Portal and hepatic congestion followed, with death from circulatory failure not long delayed. Although many drugs have been tried, none has been found capable of relieving the hepatic venous spasm caused by ascaron.

D-L Substance: Recently Boquet, Dworetzky and I[18] investigated the toxic substance discovered by Delezanne and Ledebt who found that cobra venom mixed and incubated with egg yolk evolved a toxic substance that killed guinea pigs and rabbits. We have found that the blood pressure of the rabbit and cat is rapidly lowered and that rapid occlusion of the pulmonary artery reproduced exactly the tracing that followed an injection of the D-L substance. Casts of the pulmonary vessels, with the exception of the main arterial trunks, showed occlusive spasm of the arterial vessels. In the rabbit an identical effect is caused by anaphylaxis and by lethal doses of histamine.

The experiments just described are presented to illustrate that a decreased blood pressure which is used as one of the chief criteria of shock may be caused by a wide variety of normal physiologic mechanisms, and also that

transfusion with blood, which is the best known treatment for traumatic shock, will be of no avail if the cause of the shock is spasm of a vascular bed in the liver or the lungs of the animal. The fact is likewise driven home to us that a fall in blood pressure can result from vasoconstriction if it occurs in the proper location and with sufficient intensity.

Summary and Conclusions

1. It has been demonstrated repeatedly that anesthesia with any of the barbiturates studied is more effective in delaying shock and death than ether anesthesia when the method of inducing shock is intestinal manipulation.

2. When used as premedicants with ether anesthesia, pentobarbital sodium and atropine are very effective in delaying shock and death caused by intestinal manipulation.

3. The level of the blood pressure is used as a criterion of the presence of shock but the blood pressure does not adequately reflect marked alterations in the blood volume. Consequently it is not a wholly reliable criterion of impending shock.

4. It is advisable to proceed with extreme caution when anesthetizing animals which have been severely injured or have hemorrhaged excessively.

5. A large number of drugs and other toxic agents may produce extreme hypotension as a result of hepatic venous spasm or occlusive constriction of all the secondary pulmonary arteries.

6. Transfusion with blood is the treatment of choice for animals suffering from an inadequate circulatory blood volume. This treatment is of doubtful value if shock is owing to spasm of a localized vascular bed such as the liver or lung. As is true of many other conditions, prevention is preferable to treatment.

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In the Proceedings of the Staff Meetings of the Mayo Clinic of August 31, 1949, an article entitled, Some Problems in the Diagnosis of Actinomycosis, it is recorded that "it is generally recognized now that this organism is sensitive to sulfonamides and not to penicillin."

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In the study of the diseases of all animal species, it is possible we too often overlook the natural model of the species in question as it exists under conditions of nature—the non-domesticated prototypes of our present animals.—A. H. Quin.

Certain New Pharmaceuticals As Applied To Internal Medicine And Surgery*

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STREPTOMYCIN is well tolerated in average daily doses and would be regarded as a nontoxic chemotherapeutic agent if it were not for the high standards set by penicillin. However, when the dose of streptomycin is pushed to high levels for prolonged periods, the toxic effects on the auditory nerve become evident as characterized by the symptoms of dizziness and impaired hearing. These changes are usually reversible and the symptoms disappear after discontinuing the drug. Nevertheless, one of the obstacles to the general use of streptomycin in gram-negative infections has been the fear of toxic side effects. Consequently, the search has gone on for an antibiotic better than streptomycin. Strangely enough, the immediate answer appears to have come not in the form of an entirely new antibiotic product, but rather in a modified form of streptomycin—dihydrostreptomycin.

Dihydrostreptomycin

Things move very rapidly in the pharmacy of antibiotics, and at this time one can summarize the known facts by saying that dihydrostreptomycin appears to be equally effective but less toxic than streptomycin. Clinical studies have established its value in tuberculosis in man where large doses are required over an extended period of time[1]. If the advantages claimed for dihydrostreptomycin are confirmed in the clinical treatment of other infections, the new dihydro form will undoubtedly broaden the field of usefulness of this important antibiotic agent.

The early clinical evaluation of streptomycin and the more recent work on dihydrostreptomycin have been a cooperative program carried out and supported by university hospitals, governmental agencies, and industry†.

Animal experiments had indicated a lesser toxicity for the dihydro form as compared to streptomycin. In October 1948, Dr. Emil Bogan reported that dihydrostreptomycin is tolerated in larger doses and gives equally as good therapeutic results.

Summarizing, dihydrostreptomycin has the advantage of being less toxic, less likely to produce deafness, dizziness or various irritations sometimes observed with streptomycin therapy. This drug should not be used in minimal or primary tuberculosis in human beings who may respond to other therapeutic measures. Organisms develop resistance to dihydrostreptomycin as readily and as rapidly as they do to streptomycin. Dihydrostreptomycin may be used to treat the same clinical presentations as would be treated with streptomycin.

Bacitracin

While conducting studies on contaminated wounds in May 1943, Meleney and Johnson[2] observed that a strain of spore-forming *Bacillus subtilis* present in a mixed culture from a badly contaminated compound fracture strongly inhibited the growth of other organisms in the culture. From filtrates of a pure culture of this bacillus, a substance of high antibacterial activity was isolated. Since the patient who contributed the bacillus was a girl named Tracy, "bacillus" and "Tracy" were combined to form the name of the new antibiotic—bacitracin.

Range of Activity: Bacitracin's range of antibacterial activity closely parallels that of penicillin, affecting gram-positive organisms as well as the gram-negative gonococcus and meningococcus. This naturally provokes the question, "Why another antibiotic so similar to penicillin in its activity?" The answer is, that a number of strains of penicillin-sensitive organisms showing or developing resistance to penicillin and the sulfonamides are sensitive to bacitracin. Many infections caused by strains of gram-positive organisms of the penicillin-sensitive group which had resisted penicillin therapy, responded rapidly and completely to bacitracin.

For the present, bacitracin is recommended only for local application or local injection, because parenteral administration has been found to cause impairment of kidney function in a certain percentage of cases. Extensive re-

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†The Upjohn Company as a producer of streptomycin has participated in these studies. In December 1947, they supplied dihydrostreptomycin to Dr. Emil Bogan at the Western Trudeau Streptomycin Laboratory, Olive View, Calif., for clinical evaluation in tuberculosis.

search now under way may eventually remove this kidney-irritating factor.

Inactivation of bacitracin by an enzyme such as penicillinase, the defense mechanism by which certain pathogenic organisms are able to inactivate penicillin, is virtually unknown. The importance of this fact is obvious when one considers that a combination of organisms occurs commonly in mixed skin infections. In addition, bacitracin is not inactivated by blood plasma, pus, or necrotic tissues, which affect adversely other antibacterial agents, particularly penicillin.

The experimental and laboratory bacteriological results demonstrating the marked superiority of bacitracin over a wide variety of medications in current use have been substantiated clinically. At the University of Michigan, cultures taken from infected wounds on the surgical service and from the nose and throat on the ENT service showed a significant percentage of penicillin-resistant organisms which were sensitive to bacitracin. The clinical response of patients paralleled closely the sensitivity of the organisms to this antibiotic.

At the University of Wisconsin, studies of organisms isolated from infected wounds showed mixtures of colon bacillus and streptococcus. If topical penicillin were used, the colon bacillus—a notorious penicillinase producer—would inactivate it, rendering it unable to check the streptococcus, usually the chief offender in such a combination. Bacitracin, on the other hand, is effective in such mixed infections because it is not inactivated by the colon bacillus.

In a series of patients studied at Louisiana State University, bacteriological analyses of upper respiratory infections treated with nasal solutions showed the bacitracin-sensitive organisms were effectively eliminated. Intranasal instillation of bacitracin solution produced prompt responses as indicated by fewer hours of symptoms in the treated group as compared with the control group.

Several investigators have been able to show good clinical response in a variety of superficial eye infections following instillation of bacitracin solution into the conjunctival sac or application of baciguent ophthalmic ointment.

Meleney and Johnson reported 88% favorable response to local therapy in a series of surgical infections. These lesions included abscesses, infected wounds, furuncles, undermining ulcers, chronic osteomyelitis, styes, varicose ulcers, and impetigo. Response was usually prompt, and in many instances dramatic. In this particular study it was observed that organisms isolated from infected wounds were more sensitive to bacitracin than to penicillin.

Side Reactions: Allergic reactions are a distressing accompaniment of antibiotic therapy. About 6% of patients receiving penicillin for the first time are sensitive to penicillin; this increases to about 15 to 18% of patients who have previously received this drug. Allergic reactions to bacitracin even on repeated applications are rare; patients sensitive to topical penicillin or sulfonamides may tolerate this product readily. Therefore, one of the outstanding advantages is the almost complete lack of allergenicity.

Summary: Definite advantages over other antibiotics and the sulfonamides make bacitracin the agent of choice in conditions where topical antibacterial therapy is required. These advantages, grouped into four major categories, are:

1. Efficacy: It covers a wide range of infections and is often effective in infections which do not respond to other antibiotic or sulfonamide therapy. Blood, pus, plasma, and necrotic tissue do not inhibit its activity. Inactivation by enzymes is virtually unknown. It increases in effectiveness in direct proportion to its concentration. There is a possibility of synergistic activity with penicillin and streptomycin.

2. Toxicity: It is less toxic in topical clinical doses than penicillin, streptomycin or the sulfonamides. However, because of its toxicity *via* the parenteral route, bacitracin is restricted to topical administration. Side reactions following its use are not only fewer, but also milder.

3. Allergenicity: Allergic reactions following its administration are rare; the large group of patients who exhibit sensitivity or allergic reactions to other antibiotic substances and the sulfonamides can usually tolerate bacitracin without difficulty. Even repeated applications rarely cause patients to develop sensitivity.

4. Fastness: One of its outstanding characteristics is that the development of bacterial resistance has not been a serious objection to its use. The occasional bacterial resistance which does develop is of lower order.

As a newcomer in the field of topical therapy, bacitracin should find a place of distinction along with penicillin, streptomycin, and the sulfonamides in every veterinarian's antibacterial armamentarium.

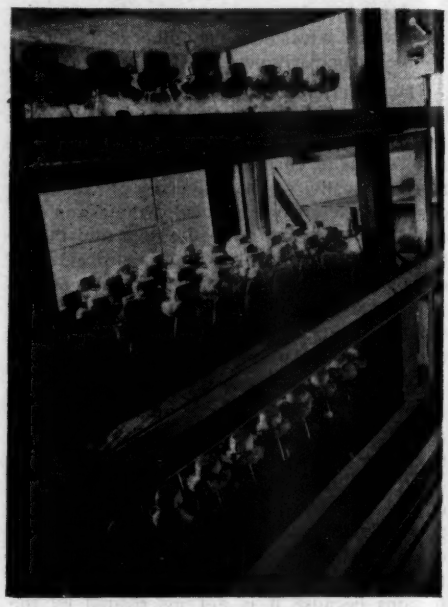
Vitamin B_{12}

The discovery of vitamin B_{12} by Rickes and colleagues in 1948[3], was the culmination of approximately 22 years of attempts to isolate a pure substance, or substances, from liver, possessing the activity of liver extracts in producing remission in patients with pernicious anemia. It had long been known that liver contains several nutritional principles in addition to the factor or factors concerned in red blood cell regeneration, but whether a single factor was concerned with both the hematologic and neurologic aspects of pernicious anemia has been a subject of considerable speculation. Recent clinical studies in human beings indicate that vitamin B_{12} is capable of inducing both hematologic and neurologic remission in pernicious anemia in doses measured in micrograms. Biochemical as well as clinical evidence indicates that vitamin B_{12} is the active antipernicious anemia principle in liver extracts.

Isolation of Vitamin B_{12} from Liver: In the period from 1926 to 1948, many attempts were made to isolate the active antianemia principle or principles of liver. This work was retarded by the lack of a chemical or biological method by which the potency of isolated fractions could be tested. All fractions, therefore, had to be tested clinically, and patients in sufficient numbers with pernicious anemia were not available for this purpose. While these investigations resulted in the production of concentrated extracts, attempts to isolate the active principle were unsuccessful.

In 1940, folic acid, a new member of the vitamin B complex, was isolated from liver and it was thought that possibly this substance would prove to be the active principle of standardized liver extracts. Following its synthesis in 1945, large amounts became available for clinical trial. It soon became evident that while this factor is hematopoietically active in the treatment of pernicious anemia, it is not effective against the neurologic complications of this disease. Folic acid was shown to be as active orally as by the parenteral route and in this respect differs from liver extracts. A rather high incidence of persistent glossitis was observed in human patients treated. Furthermore, it was known that liver extract contains folic acid in amounts too small to be hematopoietically active. It was thus apparent that there still remained an unidentified principle, or principles, in liver.

Further investigation demonstrated folic acid to be effective in the treatment of other types of macrocytic anemias associated with megaloblastic change in the bone marrow, such as in sprue, the macrocytic anemias of pregnancy and infancy and nutritional macrocytic anemia. These studies indicated that its effect differs from that of liver extracts in other respects. Large doses have been reported to be effective in some cases of macrocytic anemia of pregnancy which are not benefited by liver extracts. There is likewise evidence indicating that folic acid may be more effective than liver extracts in the treatment of sprue. In addition to its effect in hematopoiesis, folic acid appears to have other important functions such as its role in promoting absorption of fat and the fat soluble vitamins in patients with sprue.



Second stage in the production of streptomycin and subsequently berubigen (vitamin B_{12} concentrate). The spores have been transferred from the agar slants to flasks containing special media. The flasks must be agitated to furnish oxygen necessary for the growth of the molds.

The Lactobacillus Lactis Dorner (LLD) Factor: A biological method by which the antipernicious activity of fractions derived from liver could be determined was supplied by Shorb[4,5]. This came as the result of a search for a microorganism which could be used for the assay of a factor in liver needed for growth in rats. It was found that *Lactobacillus lactis*, Dorner, required the presence of two unidentified factors for growth in an amino acid, basal medium containing all the synthetic B vita-

mins. One of these (the LLD factor) was found in high concentrations in liver extracts active for rat growth. When the amount of various liver extracts necessary to support growth of cultures of this organism was determined, it was observed that the growth supporting activity bore a linear relationship to the activity of the extracts expressed in U.S.P. units. Shorb, therefore, suggested that the LLD factor is the therapeutically active principle in liver extracts.

Employing Shorb's method as a guide in further concentration and purification of liver fractions, Rickes and colleagues[3] succeeded in isolating, in exceedingly minute amounts, a highly active crystalline substance in the form of small red needles. This substance has been designated as vitamin B_{12}. Vitamin B_{12} contains phosphorus, nitrogen, and cobalt, but no sulfur, and has a molecular weight between 1,550 and 1,700. The presence of cobalt in the molecule is of interest since this is the first evidence that this element is essential in man.

Animal Protein Factor: Vitamin B_{12} appears to be intimately related to a nutritional factor commonly referred to as animal protein factor (APF), chick growth factor in chicks, or zoopherin in rats. In 1943, Berry and colleagues[6] found that chicks maintained on feeds containing soy bean meal, as the sole source of protein, became deficient in certain factors which were adequately supplied by additions of small amounts of animal protein feeds. These findings have been amply confirmed by other investigators. Good sources of the animal protein factor include packing plant meal, liver extracts, hen feces, crude casein, and fish meal, as well as aqueous extracts and concentrates of fish meal.

Hens fed diets deficient only in APF produce eggs with low hatchability and chicks with low viability and retarded rate of growth. There is likewise a high mortality and retarded growth rate in the offspring of female rats fed a similar diet. These changes can be prevented or relieved by the incorporation of APF in the diet.

As recently as 1947, little information was available concerning the properties of the unidentified growth factor. However, during the past several months it has been shown that vitamin B_{12} in amounts ranging from 1.5 to 6.0 micrograms per kilogram of ration can replace the APF or liver extracts in producing growth in deficient chicks. These and other data indicate that APF—the active principle of liver extracts—and vitamin B_{12} are, in all probability, identical.

Production of Vitamin B_{12} from Cultures of Streptomyces griseus: Because of the extremely minute quantities of vitamin B_{12} obtainable from liver and since many of the natural vitamins may occur in diverse animal, plant, and microbiological materials, it seemed probable that this vitamin might be obtained from other sources. Accordingly Rickes, *et al.*, investigated a number of possible sources, including cultures of several species of streptomyces. A red crystalline compound was isolated from cultures of *Streptomyces griseus* which was shown to be identical with vitamin B_{12} on the basis of physical and chemical properties, growth promoting activity on cultures of *Lactobacillus lactis*, Dorner, (LLD), growth promoting activity in chicks (APF) and clinical effectiveness in patients with pernicious anemia. Berubigen is obtained from this source and is standardized by its growth promoting activity on cultures of *L. lactis*, Dorner.

Clinical Results with Vitamin B_{12}: West[7] was the first to show that vitamin B_{12} administered intramuscularly, is capable of producing maximum reticulocyte response followed by an increase in red blood cells and hemoglobin in human patients with pernicious anemia. Subsequent investigations have also shown that rapid clinical improvement similar to that obtained with standardized liver extracts is obtained with this therapy. The observations to date indicate that one microgram of vitamin B_{12} is equivalent to approximately one U.S.P. unit of liver extract. Vitamin B_{12} is thus the most active hematopoietic substance known.

Response of the Neurologic Complications of Pernicious Anemia to Vitamin B_{12}: The response of the neurologic complications of pernicious anemia to vitamin B_{12} is of great interest since it indicates that the effectiveness of liver extracts is probably due to this single factor. The clinical effect of vitamin B_{12} on the neurologic complications of pernicious anemia is much more difficult to evaluate than the hematopoietic response. The response of neurologic symptoms to treatment may be extremely slow, particularly if they are of long duration and due to lesions in the central nervous system. Conversely, relief of such symptoms may be rapid if they are of short duration or of peripheral origin. The observations thus far reported indicate that vitamin B_{12} is capable of arresting progression or producing remission of the neurologic complications of pernicious anemia. However, Jones[8]

nas cautioned that further clinical studies are necessary before final judgment can be made on this important point.

General clinical improvement and maximum hematopoietic responses have also been obtained following the intramuscular administration of adequate doses of vitamin B_{12} to patients with sprue, nutritional macrocytic anemia and macrocytic anemia of infancy.

Toxicity: Studies of the acute and chronic toxicities of vitamin B_{12} in laboratory animals have indicated that this preparation is less toxic than equivalent amounts of liver extract. Clinically, it is well tolerated and does not elicit the painful reactions occasionally associated with the intramuscular administration of liver extracts. Patients sensitive to liver extracts may receive injections of vitamin B_{12} without the development of allergic reactions. However, a few patients have become sensitized to this preparation, as manifested by the development of urticaria. This sensitization is apparently due to substances other than vitamin B_{12} derived from cultures of *Streptomyces griseus.*

Vitamin B_{12} is available from The Upjohn Company as berubigen, containing ten micrograms of vitamin B_{12} per cubic centimeter, in 10 cc. size vials.

Caparside Sodium, 1%

Otto and Maren[9] have announced that caparside sodium (Abbott) is an effective anthelmintic for veterinary use in the treatment of *Dirofilaria immitis* infection in dogs. Fifteen daily intravenous injections kill the adult filaria. The microfilaria in the bloodstream gradually decreases in number after a full course of treatment.

Recently Jackson[10] reported that it appears effective treatment of long standing heart worm infection in dogs cannot be readily anticipated even though the adult worms are killed by caparside therapy, but, if the infection is treated in the early stages, the prospects are favorable, especially in young dogs. Yarborough[17] reports treating a series of 49 dogs with caparside in doses of 1 cc. for each ten pounds of weight daily for 15 days, and that the drug was effective and well tolerated. The usual dose of caparside sodium is 1 cc. per ten pounds of body weight daily for 15 days. This dose is given intravenously, care being taken to avoid leakage into the tissues. This dose is equivalent to 0.18 mg. of arsenic per pound. Exercise should be restricted during treatment. A three day course of fuadin (Winthrop-Stearns) may be given two weeks following the full course of caparside in order to rid the animal of the microfilariae promptly.

Chloromycetin

Chloromycetin[11] is a pure, crystalline substance exhibiting specific antibiotic activity. This new antibiotic is obtained from cultures of *Streptomyces venezuelae*[12] and can be manufactured synthetically. It has proved to be effective against certain rickettsial diseases as well as bacterial and viral infections[13]. These diseases include typhoid fever, bacillary urinary infections, enteric infections, atypical pneumonia, Rocky Mountain spotted fever, scrub typhus, undulant fever, and psittacosis. The length of treatment with chloromycetin (Parke, Davis & Co.) is variable and is dependent on the character of the infection.

This antibiotic shows considerably more activity in broth cultures against several gram-negative organisms than against gram-positive and acid-fast species. When compared with streptomycin, chloromycetin is approximately one-tenth as active against streptomycin strains of *Mycobacterium tuberculosis.* This antiboitic is seven to 36 times as active as penicillin against tested gram-negative species, but much less active against *Staphylococcus aureus.* The antibiotic appears to have only negligble effect against protozoa. *In vitro* tests against various fungi are also negative.

Experimental rickettsial infections in animals responded promptly to therapeutic amounts of chloromycetin[14], but when tested against experimental avian malaria and rabbit syphillis, it proved ineffective.

Tolerance studies in dogs[15] showed that chloromycetin given intramuscularly during a 24-day period as a propylene glycol colloidal solution in amounts varying from 72 to 88 mg. per kilogram per day in two doses resulted in slight gains in body weight, and indication of nontoxicity. Slight transient rises in temperature occurred and also an increase in pulse rate. An anemia developed in varying degrees in these animals on this dosage schedule.

None of the four dogs receiving parenteral or oral doses showed significant changes in total white cell or differential blood counts, blood nonprotein nitrogen, blood sugar, or bromsulfalein liver function tests; there were no alterations in behavior traceable to drug toxicity.

There was no evidence of albumen in the urine, which maintained a pH and specific gravity within normal limits.

Chloromycetin appears to be either fairly rapidly excreted or inactivated in animals.

According to available information it ap-

pears that this drug is an important new addition to antibiotic therapy.

It would seem promising in the treatment of certain infections in domestic animals according to laboratory findings. However, it will be necessary to determine its full usefulness in veterinary medicine by extensive experimental and clinical use.

d-Tubocurarine Chloride, Sterile Solution

d-Tubocurarine chloride is the chloride salt of a quaternary ammonium base alkaloid obtained from the crude substance curare. Curare is a generic term for various arrow poisons, the use of which dates back to the early Greeks. An interesting sidelight reveals that the words, toxicity, toxicology, toxin, etc., have their origin in the Greek word *toxikon,* meaning arrow poison. However, the term curare as now used in medical literature refers specifically to the motor nerve paralyzing substance obtained from the plant species, *Chondadendrum tomentasum*[15] and first described by Sir Walter Raleigh in 1595 as being used by South American Indians as an arrow head poison.

The active alkaloids of curare are known to cause relaxation or paralysis of skeletal muscles by blocking the transmission of motor nerve impulses at the myoneural end plate (the termination of nerve fiber in the muscle). Curare alkaloids also block the transmission of impulses through the autonomic nervous system at the synapse[16] (that region where the fibers of one nerve cell come in contact with the fibers of other nerve cells and form a means of conducting a nerve impulse to the ultimate tissues or organs). With therapeutic doses, the order in which skeletal muscle depression progresses is as follows: muscles of the eye, eyelids, pharynx, jaw, neck (with inability to raise the head), the long muscles of the back, legs, arms, and abdominal muscles. With lethal doses, the last muscles to be affected are the intercostal and finally the diaphragm. Respiration, of course, ceases when the diaphraghm becomes paralyzed. With therapeutic doses, recovery from paralysis proceeds in the reverse order.

The muscle-relaxing or paralyzing action of *d*-tubocurarine chloride has been made use of in human beings to obtain greater relaxation of the musculature in abdominal surgery and orthopedic manipulative procedures under light general anesthesia. It is also being employed in medicine to reduce the violence of muscular contractions during metrazol or electric shock therapy and to lessen the spasticity in spastic paralysis resulting from diseases or injury of the central nervous system.

Recently a short statement in veterinary literature mentions that a few veterinary practitioners report that *d*-tubocurarine chloride is effective in relaxing the heavy muscles of the leg preparatory to bone pinning. No dosage is given.

At the present time veterinary dosages have not been established and we must draw from comparable dosages in human beings which are as follows: To obtain muscular relaxation during light anesthesia the basis of 1 mg. per ten pounds of body weight may be given as a single intravenous injection. When ether is employed, one-third of this dose is used. In spastic paralysis, injections of 3 mg. per 40 pounds of body weight may be injected intramuscularly at four day intervals. The dose is then increased until that amount is found which produces the best results.

The action of curare is antagonized by 1 cc. injection of neostigmine methylsulfate, 1:2000, combined with 1/100 gr. of atropine sulfate. Neostigmine should always be on hand to combat respiratory paralysis whenever curare is employed. In human beings, facilities for artificial respiration and intubation also must be immediately available. Such precautions should also be observed in veterinary medicine. Injections of *d*-tubocurarine chloride should always be made slowly and cautiously because of the danger of overdosage by too rapid administration. *d*-Tubocurarine-barbiturate type of anesthesia is contraindicated in patients with respiratory deficiencies, pulmonary difficulties, renal insufficiency and liver disease.

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(*References continued on page 78*)

PRINCIPLES OF ANIMAL HEALTH

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From the 62nd annual report of the Pennsylvania Agricultural Experiment Station we gather three items of interest to veterinarians. They are as follows:

1. "Cowy" flavor of milk is an indication of ketosis. The acetone bodies in the milk and the "cowy" flavor are in direct relationship.

2. A combination of penicillin and streptomycin when added to diluted bull semen controlled its bacterial contamination without reducing the livability of the spermatozoa. It is hinted that this procedure will increase the fertility of many bulls of low fertility.

3. Thiouracil, a derivative of thiourea—the latter being urea in which the nitrogen has been replaced by sulfur—effected increased gains of fat when added to the ration, and at the same time there was a decrease in heat production. We assume that all of this is a sequence of an inhibitory influence on thyroid function. The rats used in the project reported received from 0.1 to 0.2% thiouracil in the ration.

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Undoubtedly teat injuries predispose and favor infection of the bovine udder resulting in mastitis. One of these possible injuries is that induced by the milking machine. When milked by hand the milk is forced out by positive pressure. When a calf nurses it creates negative pressure, or a partial vacuum in its mouth, but this partial vacuum varies depending upon the force needed to get the milk —the vacuum is much lower in an "easy" milker than in a "hard" milker. When a milking machine is used, the resulting vacuum is the same for all types of "milkers," and not infrequently the vacuum created by the machine is excessive. Also the cow does not "give down" her milk until the stimulus is received by release of the oxytocin from the pituitary. At other times, the vacuum is continued for some time after the last drop of milk has been withdrawn, and the teat cups, with the vacuum still fully operative, are forcibly pulled off the teats. The results from an improperly used and operated milking machine are teat injuries such as fibrosis of the teat lining, eversion of the teat mucous membrane ("rosette" teat opening), and others. Then the almost universal *Streptococcus agalactiae* steps in and another case of chronic mastitis is on its way. The dairy operator can do much in preventing mastitis by sanitation, by the lowest possible efficiency in the vacuum used, by preliminary stimulation of "letting down" the milk, and by partial release of the vacuum before the cups are removed.

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What are "hybrid" poultry, how produced, and how good are they?

The Federal Trade Commission has ruled that a "hybrid" is a chick produced by crossing inbred lines of two or more different breeds or varieties. If used under other conditions an accompanied explanation is required.

Thus, starting with four inbred lines A, B, C and D, there would be mating between A and B, and between C and D. The offspring of the two crosses are then mated, producing the double cross. The resulting progeny is the commercial hybrid.

A generalization in the present state of knowledge is that in performance tests "hybrids" are somewhat superior to purebreds. Time alone can give a correct unqualified answer.

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In a human pregnancy test the ovaries of an albino rat are first stimulated to hyperemia by the intraperitoneal injection of 0.06 units of a pituitary synergist, and two minutes later in a similar manner there is injected 2 cc. of urine, previously filtered if cloudy, though otherwise unaltered. Under suitable anesthesia, euthanasia is performed an hour later, and if the urine is pregnancy-indicative, the ovaries will be light to dark crimson in color.

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It is generally conceded by veterinarians that the warts on the teats of cattle are not of the "seed" wart virus type and usually do not respond to treatment with wart vaccine. Surgery, oil of thuja, glacial acetic acid, salicylic acid ointment, etc., are still the favorite remedies of practitioners.

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The responsibility of the veterinarian when animal pets, dogs and cats, have leptospirosis is to warn people handling them to wear gloves so as to avoid contact with the infective urine of the patients. The best results in the treatment of infected animal patients seem to follow the use of streptomycin.

The Florida Brucellosis Control Program*

C. L. CAMPBELL, JR.,** D.V.M., Tallahassee, Florida

THE topic assigned to me, The Brucellosis Control Program, encompasses not only our present state-federal program, but also the proposed adoption of some of the recommendations of the United States Livestock Sanitary Association. These latter recommendations were drafted by the U. S. Livestock Sanitary Association in an effort to establish and maintain effective uniform regulations throughout the various states in the brucellosis eradication program. Considerable time could be devoted to a discussion of this subject, but in deference to the others on the program, I shall be as concise and explicit as possible.

Florida at present employs five plans in the control of brucellosis, namely: Plan 1, test and slaughter; plan 2, test and slaughter, including calf vaccination; plan 3, test and segregation, with or without calf vaccination; plan 4, adult and calf vaccination; and plan 5, calf vaccination. These plans are essentially the same as those recommended by the U. S. Livestock Sanitary Association for adoption by the 48 states, the principal difference being in nomenclature. The U.S.L.S.A. plans are set forth as A, B, C, and D, plan A incorporating Florida plans 1 and 2. In the interest of uniformity, the Florida Livestock Sanitary Board intends to change the designations of our plans to conform with those recommendations of the U. S. Livestock Sanitary Association.

In September, our Board adopted a revision to plan 4, with respect to herd additions. Undoubtedly, you are cognizant of the varied remarks concerning the fact that Florida is the dumping ground of all classes of diseased dairy cattle; that the health status of imported animals is not consistent with the accompanying health certificate. This situation is brought about by changing ear tags from less expensive negative animals to more expensive reactors; by submitting to the laboratories blood samples from known negative cows under the subterfuge that they are from animals intended for shipment; and through various other illegal practices. With this in mind we began experimental retests of imported groups of cattle for which negative brucellosis titers were shown on accompanying health certificates, executed within the preceding ten days. Laboratory results brought out the fact that about 10% of these animals were positive brucellosis reactors. This meant that in honoring these out-of-state health certificates we were vaccinating brucellosis-positive cattle, which vaccination was valueless therapeutically and was definitely detrimental to the success of our program. Therefore, the Livestock Sanitary Board adopted the provision that all cattle entering a plan 4 herd must be negative to an official brucellosis test *made in Florida.*

Our brucellosis program has been accelerated in several counties during the past six months. In Dade and Broward counties, a milk shed comprising some 27,000 dairy cattle in 77 herds, all but approximately 1,900 cattle in 13 herds are under official supervision on one of the state plans. Sixty-five per cent of the herds, which are cooperating, are functioning under plan 4, adult and calf vaccination, which has been found to be most applicable to the so-called "commercial herd" exhibiting a high incidence of infection and to which numerous additions are made. Participation in the program by dairymen of that area is entirely voluntary, their interest having been stimulated by the results obtained in certain key herds whose owners earlier recognized the efficacy of planned supervision.

In Hillsborough and Pinellas counties a somewhat different situation exists. Sufficient interest, developed through the observation of beneficial results which were derived from participation in the program, prompted a group representing the West Coast Milk Producers Association, to confer with local health organizations in effecting ordinances directed toward the eradication of the disease. As a result of these conferences, a provision was set up in the county milk codes, and later acted upon favorably by the state legislature, which required that all dairies in these two counties be under supervision of one of the brucellosis control plans within a year from the date of inauguration, and that all reactors in the herd must have been removed within four years thereafter. It is gratifying to note that since the beginning of this program six months ago, all of the 161 dairies in Hillsborough and Pinellas counties are participating in one of our plans, 85% of which are operating under plan 4, and that from the 157 herds

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**Director, Brucellosis and Tuberculosis Control, Florida Livestock Sanitary Board.

found to be infected, one-half of the reactors have already been slaughtered.

In the first few months of accelerated activity in this area, our Board employed two practitioners on a full-time *per diem* basis in assisting three BAI veterinarians stationed there. In addition to this, some dairymen employed private veterinarians to conduct the work. This brings me to the crux of this discussion as it concerns most of you men present.

Two weeks ago I attended the annual meeting of the U. S. Livestock Sanitary Association at Columbus, Ohio. Among the groups present who represented the interests of the livestock industry was the American Veterinary Medical Association Committee on Practitioner Participation in Brucellosis Control, and we are fortunate indeed in having a member on this committee from Florida, Dr. C. E. Dee of Hollywood. The more important amendments from this committee proposed for adoption by the Association were directed toward the discontinuance of employment of lay technicians in brucellosis control; placing more emphasis on the participation of the practitioner in the formulation and administration of the program; and reduction of forms and copies of reports required. I would like to present the picture as it occurs in this state in regard to these proposals.

Florida, unlike many states, does not employ lay field personnel. The regulatory officials of this state welcome practitioner participation. Our first budget request of the 1945-47 state legislature included an item of $50,000. to pay for the services of practicing veterinarians in brucellosis work. Due to a lack of concerted effort from state veterinary organizations, the individual practitioner, and the cattle industry, the legislative bodies failed to appropriate this money. Since no subsequent interest has been exhibited by these groups, this item has not been included in our last two budgets.

The last proposal, that of reducing the number of forms required in reporting official brucellosis activities, apparently is the subject of the greatest contention in practitioner participation. Regulatory officials conscientiously recognize the numerous demands placed upon the practicing veterinarian for his services; likewise, it is felt that inasmuch as the practitioner is indebted to the livestock industry for his livelihood, he should realize that he has as great an obligation to his client in certifying the service which he has rendered as he has in performing the actual work itself. This certification can be effected only through the rendition of properly executed reports. The U.S. Livestock Sanitary Association has recommended that the Bureau of Animal Industry make a careful study of the forms required in order to simplify, if possible, the reporting. This will no doubt be done.

I want to emphasize that Florida is making great strides in the eradication of brucellosis but there are many obstacles yet to hurdle. To replace the prevalent attitude of complacency, educational policies must be developed so that the public will realize the necessity of eliminating the disease. Further, the antipathy which exists at times between the interests representing the industry must be dispelled. Brucellosis may be eradicated only through the cooperative efforts of all whose subsistence is dependent upon the health of the nation's livestock.

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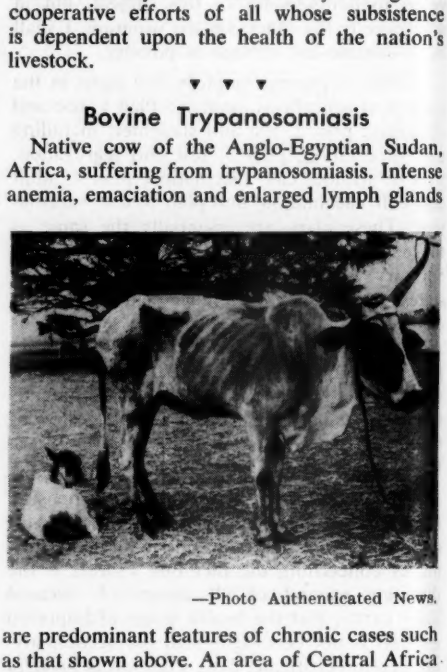
Bovine Trypanosomiasis

Native cow of the Anglo-Egyptian Sudan, Africa, suffering from trypanosomiasis. Intense anemia, emaciation and enlarged lymph glands



—Photo Authenticated News.

are predominant features of chronic cases such as that shown above. An area of Central Africa of 4,500,000 square miles has been precarious for man and beast because of the ravages of the vector-carried trypanosomes and the resulting debilitating disease frequently referred to as Nagana (tsetse disease), Gambia fever, and others, depending on the species involved. The diseases due to these blood parasites have been largely responsible for the lack of development of this vast area. Promising is the reported experimental effectiveness of the chemotherapeutic agent antrycide, for the control of this group of diseases. If practical control of the Trypanosoma is possible, this African area is said to be one of the greatest potential livestock producing areas of the world.

Clinical Diagnosis Of Infectious Canine Hepatitis And The Use Of Fox Encephalitis Antiserum*

JOHN E. CRAIGE, V.M.D., Seaside, California

INFECTIOUS canine hepatitis is a newly recognized disease of dogs. Rubarth, in Sweden, 1946, first reported the disease and isolated the filterable virus causative agent. Since then there have been cases reported from many sections of this country, England and Sweden. Accurate diagnosis can be made by histological examination of the liver and other tissue and demonstration of the typical pathology and the inclusion bodies. The clinical diagnosis seems to be rather difficult. Last year Doctor Coffin, pathologist at the Angell Memorial Hospital in Boston, stated that even after several cases had been followed through autopsy and discussed in their weekly seminar the very able clinicians at that institution were unable to diagnose it accurately.

The published reports give such indefinite and conflicting symptoms that diagnosis on the basis of such reports is extremely hazardous. Some of this conflict can be explained. Studies on the intestinal tract indicate that many dogs harbor infectious organisms with few or no symptoms until something lowers the resistance of the animal. The result is that these microorganisms become complicating pathogens. Probably other such infections will be discovered as time goes by. Infection with the virus of hepatitis would undoubtedly produce this lowering of resistance as would distemper, and other general infections. Thus, many natural and even artificially induced cases of infectious canine hepatitis are probably complicated by secondary infections of the intestinal tract and the respiratory system by bacteria or other viruses. In this study, an attempt has been made to eliminate at least the intestinal complications and to consider as pathognomonic only those symptons which could be produced by liver dysfunction.

Concurrent with the discovery of canine hepatitis, the Fromm Laboratories discovered a virus causing encephalitis among foxes. This disease being of considerable economic importance, an effective antiserum was produced and marketed. It soon became apparent that fox encephalitis virus was either identical with or closely related to the virus of infectious canine hepatitis. Fox encephalitis antiserum has been demonstrated to be of value in experimental hepatitis but its successful use by the clinician requires the ability to diagnose the disease accurately during the early stages, since the serum has little value for other diseases and is too expensive to be used routinely if it is not definitely indicated. Fox encephalitis antiserum has been used in the treatment of many clinical cases of infectious hepatitis during the past year and we feel that this serum is a specific treatment if properly employed.

Before Rubarth's publication had stimulated our awareness of hepatitis, many cases dying of an undiagnosed acute infectious disease were observed which are considered now to have been infectious canine hepatitis. Several cases were encountered after this, before fox encephalitis serum was used, in which autopsy and histologic examination established the diagnosis. From the cases observed during this period two syndromes were recognized which were dependent on the rate and extent of liver destruction, (1) acute liver insufficiency, and (2) subacute hepatitis.

Acute Liver Insufficiency

Acute liver insufficiency is a spectacular disease. It usually starts with vomiting and mild depression and all but the most observant conscientious owners overlook this initial stage. It quickly progresses, often in two to five hours, into an alarming depression and coma. Most cases that reach our office alive are completely comatose with a lowered temperature, depressed pulse and slow, shallow respiration. The owners usually report that the dog was apparently normal when last seen and had just been found in this state and rushed to the veterinarian. Until this syndrome was understood, animals invariably died shortly after arrival and a tentative diagnosis of poisoning with one of the new poisons, such as antu, might have satisfied the client but did not completely satisfy us. The acute nature of this disease suggests that many cases died before they were even known to be sick. Such cases are occasionally reported to the veterinarian and are difficult to explain on any other basis if there is no evidence of spasms,

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purging, bloody vomiting or other symptoms which could suggest poisoning.

Doctor Coffin suggested that liver damage would produce hypoglycemia and felt that some of the symptoms might be due to the low blood sugar level. Following this line of reasoning we gave 10 cc. of 50% dextrose solution intravenously to a four-month-old English Setter puppy bitch, moribund with typical acute liver insufficiency. She had been observed to vomit her breakfast and was slightly less playful than usual afterward but no significance was placed on this until she was found comatose in the late morning and rushed to the hospital. Within one minute after completing the injection, the puppy was apparently normal and was romping around the office, like any other English Setter puppy. Naturally we all felt very pleased and proud, but not for long. She gradually retrogressed and was again practically comatose four hours later. Another injection of dextrose produced another rally, but not so complete and lasting only two hours. After this, little change was effected by dextrose and the puppy died in spasms at 7 o'clock that evening.

Little gross pathology was observed on autopsy, but extensive evidence of acute diffuse hepatitis was apparent on histological examination of the liver. This suggests that hypoglycemia is the primary cause of death in acute liver insufficiency but that other disturbances quickly follow even if dextrose is given, where gross tissue damage involves the liver.

Another similar case was observed. This case was kept alive by intravenous transfusion of dextrose, bovine serum albumin and amino acids for over 48 hours. On histologic examination the liver was scarcely recognizable. Not a single intact liver cell could be found. The cytoplasm was gone and the nucleus was either greatly swollen or disintegrated. All that remained to identify the tissue was the arrangement of the stroma.

According to these cases, acute liver insufficiency occurs when all or a high percentage of the liver cells are attacked simultaneously by the virus.

Subacute Hepatitis

Subacute hepatitis presents an entirely different syndrome and occurs when enough of the liver remains functioning to sustain vital processes. Such cases present more typical symptoms of acute general infection. The animal becomes sick, loses appetite and pep, the conjunctiva is inflamed, a watery discharge is noted from the eyes and nose: there is usually some tonsillitis, the temperature is high (104 F. to 106 F.) and remains high during the course of the disease; vomiting is characteristic; frequently, if there are no intestinal pathogen, the stools are scant and tarry. If this is allowed to go untreated, symptoms will continue for a week or two. Many cases in my experience have died before serum was used, but some recovered uneventfully or with jaundice as a sequel to the infection.

Case Reports

Following are case reports that demonstrate the value of fox encephalitis antiserum in these two conditions.

Acute Liver Insufficiency: A six-year-old, large, male black and tan American Cocker Spaniel was presented in a state of coma shortly after noon one day. The owner reported that the dog had not eaten well that morning and had seemed slightly listless, but not alarmingly so, and that he had been found in this state when the owner came home to lunch. The dog had been under my care for about 18 months and there was no significant history. Temperature was not taken, time is too essential in these cases; the pulse was slow and weak. Intravenous injection of 10 cc. of 50% dextrose solution was given immediately. By the time the injection was complete, tone started returning to the muscles and in less than one minute the dog was apparently normal. Fox encephalitis antiserum (15 cc.) was also given, one-half intravenously and the rest subcutaneously. The dog was kept in the hospital for 48 hours, no further medication was given and as far as we could tell the animal remained perfectly normal during this period. He was next seen three months later and had had no recurrence of symptoms.

There may be some other explanation for the continued improvement in this case but it is believed that the dextrose relieved the hypoglycemia as in the other cases and that the fox encephalitis antiserum neutralized the virus and stopped the destruction of the liver tissue, allowing regeneration and recovery.

This is the only case of acute liver insufficiency in which I have been able to use fox encephalitis antiserum. Most cases die before the owner realizes the dog is sick.

Subacute Hepatitis: Fox encephalitis antiserum has been used in 20 cases on which a tentative diagnosis was made of subacute hepatitis. Four of these cases will serve to demonstrate the effectiveness of the serum. The first case was a two-year-old English Setter show dog. Eight days before the Del Monte Dog Show he started vomiting, refused to eat and was listless. As soon as these symptoms were

noticed he was presented for examination. He was found to have a temperature of 106 F., slight tonsillitis, inflamed conjunctiva, slight abdominal tenderness, no intestinal pathogens and no evidence of respiratory infection. A diagnosis of acute tonsillitis was made and penicillin and sulfonamides were administered. Symptons continued without improvement over the week-end and streptomycin was given orally and intramuscularly. No food was retained, but amino acids and dextrose were given subcutaneously. Salicylates were given to relieve the fever but it remained between 104 and 106.5 F. for this entire period. On Tuesday, it was decided to try fox encephalitis antiserum, which had to be ordered from San Francisco, 125 miles away. This arrived Wednesday afternoon, at which time 30 cc. were injected, one-half intravenously and one-half subcutaneously. The vomiting ceased within a few hours after the injection. Next morning the temperature was 103 F. and that evening normal. The dog ate a good meal, which he retained. He remained normal and was shown in the dog show on the following Sunday.

Another show dog, an 11-month-old German Shepherd male, was presented with similar symptoms a few days before the Del Monte Dog Show. Symptoms noted were; temperature 106 F., vomiting, and tonsillitis. In addition to penicillin and sulfonamides, 35 cc. of fox encephalitis antiserum were injected subcutaneously. The dog had been treated by another veterinarian for four days before presentation. No record of the previous treatment could be obtained. The dog was visibly improved within six hours, was apparently normal 24 hours later and was also shown as scheduled. About ten days later this case developed corneal opacity in one eye and then the other, which disappeared after a few days.

The next case was a Giant Schnauzer named Garry. This dog had had a varied history. He had been under my care for about two years during which time he had suffered some skin trouble, a cystotomy, several attacks of acute prostatitis, chronic proteus dysentery, and small spirochetes. At this time he apparently had been perfectly well for about four months. Initial symptoms of vomiting and listlessness were reported. The temperature was 105.2 F. Thinking that there was a relapse of some of his other infections, penicillin and streptomycin were given. No improvement was observed for 48 hours, at which time 40 cc. of fox encephalitis antiserum were injected subcutaneously. He responded immediately and was apparently normal within 24 hours. Several days later he started vomiting again. There was no fever this time but a yellow discoloration was noticeable in the conjunctiva, sclera and gums. This was considered to be a result of liver damage and bile salts were given. All symptoms disappeared in a week or so.

The fourth case was a mature, small, mixed breed that had been boarding in a local kennel. When it refused to eat the kennel operator took its temperature, which was noted to be 106 F. and brought it in for diagnosis. The only symptom other than the elevated temperature that was observed was a tonsillitis, so a tentative diagnosis of acute tonsillitis was made and the dog given penicillin and sulfonamides. A favorable prognosis was given the caretaker. The kennel operator returned the dog the next day. The temperature was unchanged, less vomiting had occurred but no general improvement was apparent. At this time 10 cc. of fox encephalitis antiserum were given subcutaneously. The dog was better by evening and next day the temperature was normal and the symptoms apparently completely relieved.

These cases were selected because each of them received other treatment that was apparently unsuccessful before being given the fox encephalitis antiserum. The other cases were given serum at the time of the original diagnosis. They also responded immediately as those reported.

It is dangerous to assume that since improvement follows when a certain treatment is given that such treatment effected the improvement. It is also hard to evaluate treatment, especially in private practice, where everything which might be helpful must be given to every patient. However, I feel that fox encephalitis antiserum is specific for the treatment of infectious canine hepatitis, because of good results obtained from its use and the unsatisfactory experience with the disease before the serum was used. During the period covered by this report another veterinarian in the area reported a number of cases of what I would diagnose infectious canine hepatitis which failed to respond to usual treatment.

Previous experience with cases of this nature convinces me that the serum had great value in a large percentage of these cases.

Diagnosis

Assuming that the serum is of value, the clue to its successful use is accurate clinical diagnosis. The diagnosis of acute liver insufficiency presents little difficulty. If an injection of dextrose restores a comatose dog to normal, hypoglycemia was present and there is nothing I know of that can produce a

sudden hypoglycemia except liver insufficiency. Subacute hepatitis presents a much more difficult problem. Since vomiting is characteristic, hepatitis is suspected in any case where vomiting is reported. A temperature of 106 F. is fairly indicative but a lower temperature, even normal or subnormal, does not rule it out. Tonsillitis and the other symptons are indicative but also not pathognomonic. I have seen cases of hepatitis without tonsillitis, and tonsillitis from other causes. The prevalence of established cases of hepatitis in a certain area should be taken into consideration in making the diagnosis. Very little seems to be known about its epizootiology but experience indicates that it is likely to take the form of a sporadic outbreak, occurring simultaneously in several dogs in widely separated communities. I have never encountered an outbreak in which a large percentage of dogs in one kennel or one neighborhood became infected. Quite the contrary, I have found two cases, each in a large kennel with no known exposure to other dogs and no other cases developing.

The real test of the diagnostician is in differentiation. Practically all acute general infections present symptoms similar to those of hepatitis, and hepatitis can easily be mistaken for distemper or leptospirosis. Although vomiting occasionally accompanies these infections, it is usual in hepatitis, and should be considered. Vomiting cases are handled in the following manner: The vomitus and stool are examined microscopically for internal pathogens which are treated specifically when found; if there is inappetence and fever and no intestinal infection, a tentative diagnosis of hepatitis is made and an injection of fox encephalitis antiserum is given; if marked improvement does not occur within 12 to 24 hours, the case is re-examined for foreign bodies or poisoning. Cases without fever, in which poisoning is suspected at the outset, are frequently given an injection of the serum as supportive treatment.

Treatment

Following the directions of the manufacturer, an initial injection of 0.5 cc. of fox encephalitis antiserum per pound of body weight is given. This is repeated in 48 hours if it seems to be required (about one case in ten). Penicillin in oil and wax is injected intramuscularly. If there is any depression 5 to 10 cc. of 50% dextrose solution are injected intravenously. Dextrose is also given in the form of karo syrup, one tablespoonful every three to six hours. Methischol, a preparation containing methionine, inositol and choline is dispensed in capsule form to be given every three to six hours during the acute stage. Methionine is known to prevent damage to the liver and to aid in its regeneration. These cases are seldom hospitalized. Prompt improvement is expected and the owner is usually sufficiently alarmed to continue treatment during the night for a day or two. A careful examination is made for other infections and these are treated specifically when found. Fluid intake is increased and no solid foods are given until there is definite improvement. A checkup is made in 12 to 24 hours, and again in 48 hours, at which time most cases are apparently normal and medication is discontinued. Some cases develop jaundice and other symptoms of liver damage. These are given bile salts until abatement of the symptoms.

I feel that the name "fox encephalitis" is an unfortunate one to attach to serum that is effective for hepatitis in dogs. It suggests that it should be used to treat encephalitis in dogs. In fact, the serum was originally promoted as a cure for so-called "chewing fits" in puppies. This was extremely misleading since this type of convulsion, while occuring in the terminal stages of hepatitis is also encountered with distemper, coccidiosis, giardiasis, other dysenteries, and chronic bronchitis. In my opinion, this type of fit, and for that matter, chorea, and other nervous disorders are not manifestations of encephalitis but result from degenerative changes in the brain brought about by any long drawn out, debilitating disease. Every practitioner among you will recall several cases in which distemper was extremely unlikely due to age, inoculation, or previous infection with distemper, which developed chorea, pitted teeth, or fits.

A great deal more study needs to be conducted on this subject before we shall understand it fully but it is safe to assume that the fox encephalitis virus is not an important factor in encephalopathies of dogs and the serum will not be of much value in their treatment. Several practitioners have told me that they used fox encephalitis antiserum to treat fits in dogs, without success.

I suggest that the serum be called canine hepatitis antiserum and promoted to veterinarians as a treatment for hepatitis of viral origin.

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At present, the Army maintains some horses at Fort Myer, Va., for use in military funerals and parades. There are a few pack animal organizations at Camp Carson, Colo. A small number of horses have been retained also at Fort Riley for training purposes. In all, 327 horses remain under jurisdiction of the Army in the United States.

Certain Operative Procedures On The Mammalian Heart*

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IT IS common belief even among biologists that the mammalian heart is an extremely delicate organ and that operations upon it are quite impossible. It is true that cardiac surgery has certain inherent difficulties that must be overcome or dealt with. The principal disadvantage of cardiac surgery is that the heart must continue to pump an adequate supply of blood to itself and the rest of the body while an operation is in progress. Any operation on the heart is feasible if the fundamental function of the heart is not too severely reduced. It is the purpose of this paper to describe a number of successful procedures that have been carried out on mammalian hearts.

Observations on the Cardiac, Aortic and Pulmonic Valves in Beating Hearts

Smith, Baldes and I[1] have made a motion picture of the beating heart in which the action of the cardiac, pulmonic and aortic valves has been filmed. This has made possible a study of the origin of the heart sounds, since the activity of the cardiac valves and the electrocardiographic effects have been recorded simultaneously. Observations of this nature were made possible because physiologists had developed methods of keeping the heart beating for many hours after its removal from the body of the animal. The perfusion of the isolated heart of the rabbit or dog is a common laboratory procedure. In its simplest form it consists of cannulating the aorta and connecting it to a reservoir of oxygenated Ringer-Locke solution which is placed at a sufficient height above the heart to provide the coronary arteries with a pressure of about 100 mm. of mercury. Incision and retraction of the atrial walls permit observation of the mitral and tricuspid valves. With proper illumination the pulmonic valves can be observed quite effectively by opening and retracting the walls of the common pulmonary artery.

The direct observation of the aortic valves requires a special cannula and an additional setup of apparatus. The first steps in the procedure are the same as for perfusing the heart in the usual manner. When the heart has established a regular rhythm, the tube supplying the aorta with the perfusion fluid is clamped and the tube which connects the aorta to the other apparatus is opened. Obviously, if the aortic valves are to be observed in operation, fluid must be pumped through the aorta. To accomplish this purpose a peripheral resistance is created as in the apparatus for heart-lung preparation. In brief, the technic consists of placing a rubber sleeve within a large glass tube (15 cm. long and 20 mm. in diameter) and reflecting the ends over the tube, where they are tied in place. The glass tube has side arms to which a pressure bulb and a mercury manometer are connected. The desired pressure is exerted on the sleeve and the proper peripheral resistance is thus supplied for the beating heart. Since the fluid is pumped out of the aorta the aortic valves can be observed opening and closing in a normal manner provided a cannula, which will now be described, is utilized. A cannula made with a wide flat top must be used. Such a cannula can be provided by making one arm of a T tube funnel-shaped and about 15 to 20 mm. in diameter. The wide portion of the cannula is covered by a thin glass disk which is glued in place. When the cannula is completely filled with fluid the aortic valves can be seen opening and closing with each beat of the heart. This preparation provides an ideal classroom demonstration of the action of the cardiac, aortic and pulmonic valves.

The relation of the action of the cardiac valves to the heart sounds can be demonstrated and the behavior of the atrioventricular ring can be observed with ease. Many questions regarding functioning of a given anatomic structure can be answered with more assurance by the evidence furnished by such a preparation.

The Coronary Circulation

Investigations of the coronary circulation which were done with Herrick, Baldes, Mann and others, required that the coronary arteries be dissected sufficiently to permit the application of a thermostromuhr unit to the desired vessel. Since the flow in the coronary arteries[2] was studied in dogs during digestion, during

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the action of such drugs as digitalis and while the animal was running on a treadmill, sterile technic and proper operative procedures were necessary. In the most successful preparations, the coronary flow was observed for as long as 21 days.

In the development of the human heart a number of defects may result, such as failure of the atrial or the ventricular septum to close completely. A communication of considerable size may persist. It seemed desirable that such defects be studied in dogs. At the request of two of our clinical colleagues, Martin and I[3] undertook to create atrial septal defects, to study their effects and to develop a means of repairing them.

The Creation of Cardiac Anomalies

In creating the defects, we expose the right side of the heart. After the pericardium had been incised, an opening was made in the septum with a scalpel thrust through the atrial wall. The blade of the instrument was then carried posteriorly and when in the proper position the septum was incised as desired. The instrument was then withdrawn and the incision was closed by a few stitches with silk thread. It was possible to determine the size of the defect by inverting the atrial appendage with the index finger and palpating the opening. Space will not permit a discussion of all the effects of this operation on the animal. Suffice it to say that the atrial septal defects did not result in the development of any untoward symptoms in the animals in which they were made.

The next step was to devise a method of closing the defect after it had been created. Many attempts were made and many failures resulted but a successful method was finally developed. It consisted of covering a piece of polythene material with a piece of inverted vein of proper size. We usually used a piece of the azygos vein removed at the time of the operation. Sutures were tied to the ends and to the upper side of the piece and straight needles were threaded on each thread. Through an incision in the atrial wall the needles were passed through the atrium at the proper points. The polythene vein patch was carried into position through the incision and sutured in place. The incisions in the atrial wall and in the pericardium were closed and the remainder of the operation was done in the usual manner.

It might be stated at this point that Griffin and I[4] have made ventricular septal defects in the hearts of dogs. Communications between the ventricles are a far more serious matter than atrial septal defects and the size of the defect must be adjusted to the size of the dog if survival for more than a few hours is desired.

Surgical Removal of Canine Heart Worms

The various cardiac operations which have just been described afforded sufficient experience in cardiac surgery to make the surgical removal of the heart worm (*Dirofilaria immitis*) seem a feasible procedure.

Through the kindness of Dr. Charles Bild of Miami, Florida, a sufficient number of infected dogs were made available to Doctor Schlotthauer and me[5] for exploring this interesting possibility.

Surgical Procedures: The animals were prepared by fasting 12 to 18 hours. They were anesthetized with pentobarbital sodium (25 to 30 mg. per kilogram). Using sterile technic throughout, we opened the thorax on the right side through the fourth or fifth intercostal space with artificial insufflation being supplied. In three of the five operations done on the right side, umbilical tape was placed around the anterior and posterior venae cavae in readiness for interrupting the return of blood to the heart when the ventricle was incised.

The ribs were widely retracted by means of a self-retaining rib retractor. After the heart had been isolated with moist towels the pericardium over the operative site was opened and retracted. The tapes about the venae cavae were drawn up to occlude the flow of blood. A short incision was made through the right myocardium and a curved hemostat was thrust through the incision. The right ventricular cavity and the pulmonary artery were explored and the heart worms grasped by the instrument were removed. When further attempts failed to yield additional worms or when the effort was unproductive, as occurred in one operation, the incision through the myocardium was closed with a continuous silk suture. The pericardium was repaired and the thorax was closed in layers in the usual manner.

In two additional operations on the right side, the return of blood was not interrupted but instead a running suture was passed on each side of the site of the incision. By tying the ends of each suture together they were looped and were crossed so that traction on them closed the incision, which was 15 to 20 mm. in length. The other features of the operation were the same.

It is fortunate that the anatomic relations of the heart and thorax of the dog are such that the right ventricle may be explored from

either the right or the left side. If it is desirable to inspect the pulmonary artery, the approach through the left side is preferable.

The operation has been done on the right side in five animals. In all except one, worms were removed. There were larvae present in the blood smears of all animals before and after the operation. A second operation was done on the left side of the thorax in three dogs. A few worms were removed from two animals. The third dog did not yield any worms at either operation. After the second operation this dog was killed and a thorough examination of the heart and pulmonic vessels did not disclose any heart worms.

Four of the series of five dogs are still alive after nearly two years. Two of the animals are negative as regards larvae in the blood and two are positive.

This work has amply demonstrated that the surgical removal of heart worms is a feasible procedure and it remains to be seen whether the operation becomes a practical method of removing the worms from a heavily infected valuable animal to which the administration of a vermifuge might be considered too great a risk. A combination of the operation with a vermifuge might offer certain advantages, since the bulk of the worms could be removed by surgical means and the small number that might be missed at operation could be killed with anthelmintics without too serious risk to the animal.

Summary

A series of surgical procedures which have been carried out on the heart has been described. Certain of them should prove of didactic value and others may point the way to the development of certain operations that may prove of practical importance as a therapeutic procedure.

That the heart is a vigorous and very resistant organ I trust has been sufficiently emphasized to stimulate interest and activity in this interesting field.

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Leucocytozoon Infection In Turkeys

BERT W. BIERER, D.V.M., Columbia, South Carolina

LEUCOCYTOZOON infection in turkeys is probably far more prevalent than we realize. The disease easily can be mistaken for fowl typhoid, fowl cholera, non-specific enteritis, or even respiratory infection, if symptoms and post-mortal lesions are considered alone. Here is a disease that can destroy up to 15% or higher of a partly grown turkey flock within a period of two or three weeks.

Leucocytozoon infection is a malaria-like disease, sometimes referred to as turkey malaria or gnat disease, due to infection with the protozoan parasite *Leucocytozoon smithi*. The disease, in heavily infected birds, produces sudden death. The acute stage is usually more or less characterized at autopsy by hepatic inflammation and sometimes degeneration; splenitis and gross enlargement of the spleen; a catarrhal enteritis; and sometimes cardiac and other changes. Losses usually occur in birds under three to four but sometimes up to five months of age. The disease is spread by species of gnats (Simulium), commonly referred to as black flies and more specifically as turkey gnats or buffalo gnats. The black flies act as vectors of the disease, within which the Leucocytozoon develops to sexual maturity. The Leucocytozoon cannot develop to sexual maturity in the turkey. It does not multiply asexually in the turkey. The disease cannot spread directly from turkey to turkey.

Diagnosis

Blood smear should be on a clean glass slide with less than one drop of blood. The heart of a cadaver is a convenient place to obtain slide material.

Tear or cut a piece of liver and make a number of smears by the touch method on clean glass slides. If more detailed study is desired, make touch smears of spleen, testicle, etc.

As soon as slides are dry, fix with absolute methyl alcohol and stain with Giemsa spirochaeta stain for at least one-half hour. As soon

as the excess stain is washed from the slide, cease washing immediately and let dry.

Examine the blood smear microscopically with a 16 mm. low power objective and a no. 10 eye-piece. By this magnification the parasites are easily distinguished from the blood cells under low power. High power can be used for more critical observations. The Leucocytozoon, if present, is beautifully stained and appears as described in recent standard textbook on protozoology or bacteriology. (Fig. I and II).

It is very important to make at least one smear from the liver or spleen tissue. This is because parasites may be found in the blood of carriers for many months after being infected and in order to establish the fact that the acute stage of the disease is present, less mature stages must be found in smears made from the internal organs. This may prove difficult at first, but one can soon acquaint oneself with the typical color and size and shape of gran-

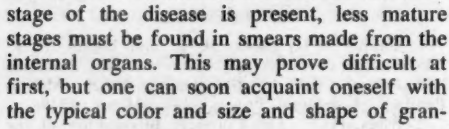

Fig. I. Leucocytozoon smithi. Some ordinary blood forms, shown with normal turkey red blood corpuscles (at right) drawn to scale. The tails may be visible only under reduced light.

ules, etc., in blood forms and then begin to be able to recognize the less mature stages by this typical staining and structure. From a color and staining standpoint, the picture is certainly quite beautiful.

If it can be established that the blood smear contains leucocytozoa, and that the smears from the liver or other organs contain less mature forms, a diagnosis of acute Leucocytozoon infection may be made. In some cases the blood smear contains numerous leucocytozoa, obviating the necessity of further examination. In order to exclude the possibility of mixed infection, cultures made from the internal organs must be bacteriologically negative.

Prevention is effective where confinement is practiced under cheese cloth screens to ex-

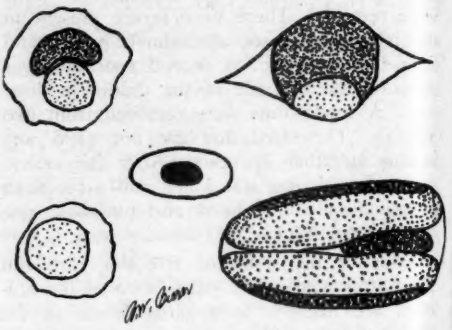

Fig. II. Leucocytozoon smithi. Immature forms from liver smear, with normal turkey red blood corpuscles (in center) drawn to scale. Outline of clear areas may be visible only under reduced light.

Prevention and Treatment

clude efficiently black flies from contact with the turkey poults. This is not a practical procedure in most cases where flocks are raised on range after a preliminary confinement rearing period. Preliminary trials strongly indicate that sulfaquinoxaline in the drinking water, exactly as used to control other infectious diseases in poultry, will promptly reduce losses from the acute stage of Leucocytozoon infection. Furthermore, the possibility appears to exist that sulfaquinoxaline, in preventive amounts in the feed, given when the poults are turned on the range, may minimize losses.

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Every effort should be taken to prevent freezing of water fountains. There are many types of heaters available for keeping the temperature of water in fountains at non-freezing temperatures; some are good and some are dangerous. Open flame, oil-burning types should be avoided since they are fire hazards. Electric heaters of the drop-in type for open fountains and soil heater cable types for wrapping pipes are examples of modern methods which are satisfactory.

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An electronic knife has been developed for killing chickens and turkeys, in processing plants.

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If youth be a defect, it is one we outgrow too soon.

EDITORIAL COMMENTS

Eradication of Bovine Tuberculosis in Great Britain

British veterinarians are looking forward to area eradication of bovine tuberculosis in Great Britain. The Minister of Agriculture has given October 1, 1950, as the date when the proposed scheme for this work will be introduced in Parliament.

Some progress in the control of tuberculosis in Great Britain has been made since 1931, at which time it was estimated that 40% of cows would react to tuberculosis. In 1945, it was calculated by Ritchie, that 30 to 35% of cows and 17 to 18% of cattle in England, Wales and Scotland would react though the number of animals slaughtered under government tuberculosis order has fallen.

Vaccination against bovine tuberculosis has been the subject of much discussion and research in England in the face of the reported saving to American livestock interests by eradication, to say nothing of the reduced incidence of human tuberculosis in this country. Editorially, *The British Veterinary Journal,* 105: 399 (Nov.), 1949, expresses doubt that vaccination with B.C.G. is a practical method of control and that the aim must be eradication, as opposed to control.

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Regional Plan for Veterinary Training

Dean R. S. Sugg, School of Veterinary Medicine, Alabama Polytechnic Institute, Auburn, outlines the operation of the regional plan for veterinary training which has resulted from the cooperative action taken by the Southern States.*

Four veterinary schools in the South; School of Veterinary Medicine, Alabama Polytechnic Institute, Auburn; School of Veterinary Medicine, University of Georgia, Athens; School of Veterinary Medicine, Oklahoma A. & M. College, Stillwater; and the School of Veterinary Medicine, Tuskegee Institute, Tuskegee, Ala., have been designated regional schools.

Students in states having no veterinary school may submit applications for veterinary education to a designated native state board which screens for eligibility and refers applications of all qualified persons to the Committee on Admissions of the school officially designated to accept students from such state. Selections made by this committee are final.

The plan was inaugurated last fall at the Alabama school with cooperating states filling their respective quotas. This plan will give opportunity for limited numbers of residents of states having no school to receive training in veterinary medicine and at the same time aid the existing schools to expand teaching and research facilities.

* The Auburn Veterinarian, Fall, 1949.

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Plans for A.V.M.A. Miami Meeting

The chief efforts of the Florida State Veterinary Medical Association for the coming year will be focused upon the annual meeting of the A.V.M.A. which convenes in Miami Beach, August 21-24, 1950. A strong local committee, headed by Dr. E. D. Clawson, Miami, of the South Florida Association, is working on what promises to be an excellent program.

Tentative plans are being made to devote two full afternoons to relaxation and recreation for visiting veterinarians during the session. It is also planned to have a post-convention boat trip to Cuba. — D. A. Sanders, D.V.M., President, F.S.V.M.A.

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Built-Up Floor Litter for Poultry

The case for the built-up floor litter for chick brooding and for laying hens gathers increasing favor from recent reports of experiments and practical results reported by poultrymen.

The built-up or deep litter system seems to violate accepted sanitary standards but it appears to have some valuable features that outweigh the long recommended and everlasting use of scoop, broom and disinfectant spray.

The ruinous losses in baby chicks due to coccidiosis, appears to be reduced markedly when chicks are housed on built-up litter. Such chicks develop resistance by exposure to light infection kept down by the several limiting factors developed in the litter.

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Mastitis in a Mare

Acute mastitis in a mare is reported by Capt. O. Muret, R.A.V.C. (*Jour. Royal Army Vet. Corps.*, 20:165 [Dec.], 1949.). The animal was presented for treatment six days after the foal was weaned. Neglect of expressing milk from the glands was assumed to be responsible for the painful inflammation and firm swelling of both glands. No secretion could be milked from either side.

The infusion of 20,000 units of penicillin in 5 cc. of sterile water in each gland daily for four days effected complete resolution.

Facts Relative to Civil Action Case Involving Brucellosis

In July of 1946, Joseph Ripplinger and his wife entered into a written farm lease with the landlord, W. H. Otten, for the farming of certain lands in Grand Forks County, North Dakota. Among other things, the lease provided that the tenant and landlord were to furnish ten head of cattle each, and that this herd of 20 head would become joint property of the two and they would share equally in the increase and the produce from the said herd. The tenant brought his ten head of milk cows which had been inspected and found free of brucellosis infection by the blood agglutination test. The testimony presented was that before the landlord delivered his ten head the tenant questioned him about testing his cattle and was informed that they came from a tested herd. These cattle were delivered to the tenant in October, 1946. In November of that year, one of the cows presented by the landlord gave birth to a calf which was sickly and died two weeks later. The previous caretaker of the landlord's cattle, Mr. Kush, discovered in the winter of 1946-47 that some of his cows were sick and gave premature birth to their calves. It was found that several of the cows were infected with brucellosis and, consequently, quarantined. Mr. Kush, knowing that Mr. Otten had taken the cattle from his herd and delivered them to his other tenant, Mr. Ripplinger, took the veterinarian over to the Ripplinger farm and that herd was tested. At that time, May 29, 1947, it was found that one cow was infected and that there were four suspects. The infected cow was sold but it developed later that the disease finally spread into the rest of the herd and, as a result, in the fall of 1948, the whole herd was sold for slaughter.

The testimony further developed that the cattle of the landlord had not been tested for a period of two years and that one of the tenants had notified the defendant, W. H. Otten, that one of his cows had aborted about a year or so earlier but the landlord did nothing about it.

In considering the fact as outlined above, the jury awarded the decision to the plaintiff, tenant Joseph Ripplinger, who was awarded $2,500. damages.

This is the first case of its kind as far as I know in North Dakota. The jury was composed of eight men, all farmers, and four women. It attracted considerable attention and was a very interesting and novel case. I am sure that the result of the case will have beneficial effect, it will emphasize the necessity for care when cattle are sold for breeding or as milking herd replacements. —T. O. Brandenburg, D.V.M.

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Effect of High Temperature on Milk Production

Initial results of experiments conducted at the Psychroenergetic Laboratory, Columbia, Mo., indicate that high room temperature caused a greater decrease in milk production than low temperatures.

An optimum of 50 F. favored both milk production and efficient utilization of feed. These tests and others are a portion of continuing experiments on environmental or housing factors affecting the health and production of animals.

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Histoplasmosis in Dogs

In the search for the source of *Histoplasma capsulatum*, the fungus which causes histoplasmosis, the diagnostic agent histoplasmin has been employed as a skin test in both man and animals. The test has known limitations of lack of specificity and failure to give positive tests in acutely ill patients and others. Of significance is the fact that of five dogs reacting to histoplasmin in a group of 837 tested,* three proved to have active naturally occurring infection. No other pathogenic agents could be demonstrated.

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Veterinary Inspection of Foods

The meticulous inspection of all foodstuffs is supervised by 300 Army Veterinary Corps officers—and currently there are vacancies for nearly 100 more. The purpose of the inspections is primarily to protect the health of troops.

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If pregnant sows are kept on a suboptimal vitamin A intake, reproduction will be normal but the pigs will be born with diminished vitality. Abnormally high mortality rates are reported in such litters.

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In cases where the ringworm scabs are thick on cattle, a mixture of sulfur iodide (one part) in light cooking oil (ten parts) has the advantage of penetration because of the softening action of the fat.

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*Prior, John A., *et al.*, An Evaluation of the Histoplasmin Reaction in the Detection of Naturally Occurring Histoplasmosis in Dogs. *Pub. Hlth. Repts.*, 64:1562 (Dec. 2), 1949.

POULTRY PRACTICE PROBLEMS

W. R. HINSHAW, D.V.M., Ph.D.
Frederick, Maryland

For a number of years hatcherymen in mountainous areas have had difficulty in getting comparable percentage hatches of turkey and chicken eggs to those obtained by their competitors in lower altitudes. This has stimulated research work to determine the reasons for the differences and Wilgus *(U. S. Egg and Poultry Magazine,* 55:15, Sept., 1949) has summarized the progress which has been made on this problem in several of the mountainous states. These studies have shown the need for better incubator controls to regulate both the air circulation and temperatures in all parts of the machine. The studies have shown that improvement in hatchability can be obtained by regulating the air flow into the incubator so that the amount of air from the fan into the incubator is reduced. A more careful distribution of the heat so that there is a more even flow to all parts was found to be essential. Earlier work at the Wyoming station showed that additional oxygen added to the incubator will greatly increase hatchability in high altitudes.

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Hall, Legenhausen, and MacDonald *(Poultry Science,* 28:344, 1949) in the first of a series of reports on fowl typhoid, summarize their studies on the nature and dissemination of the disease. According to them, the disease has greatly increased along the eastern seaboard during the last decade and is now one of the most important causes of loss in the area mentioned. Fowl of all ages are affected with about equal frequency. The losses vary with the age of the flock and in broilers may be as high as 75%. It appears to be a warm weather disease. They found that the infected bird is the greatest reservoir and also the worst disseminator. In acute cases there is extensive dissemination of *S. gallinarum,* the causative organism, through the body excretions including those from the mouth, nose, eyes and droppings. Survivors become reactors and lay infected eggs for at least 18 months.

Other factors of disease dissemination include man, animals, and various mechanical carriers. The spread also may be influenced by weather conditions and topography. According to the authors, however, these factors are secondary in a control program, the most important disseminator being the infected bird. They consider that the prompt and thorough elimination of the carriers as detected by the agglutination test is of prime importance in preventing the spread of the disease.

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All of us are prone to consider certain parasites of little importance to the poultry industry and even to accept them as necessary evils with which the birds have to live. An example is the subcutaneous tissue or flesh mite *Laminosioptes cysticola* which may infest chickens, turkeys, pheasants, geese, and pigeons. This mite is normally a parasite of the upper layers of the skin cells, but is also often seen in the subcutaneous tissue and even in the muscles. It has received recent attention by Dikmans (*Am. Jour. Vet. Res.,* 6:211, 1945) and by Lindquist and Belding (*Mich. St. Vet.,* 10:20, 1949). The latter investigators suggest that efforts should be made to determine, by surveys, the real incidence of the parasite and also its true economic significance. More research is needed on the life history in order that possible control measures may be investigated. Dr. William D. Lindquist, Michigan State College, East Lansing, has expressed a desire to receive reports on the prevalence of the mite from investigators and practicing veterinarians in other areas.

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One of the best bits of advice that you can give a poultryman is to urge him to build a disposal pit for getting rid of carcasses, hatchery wastes and other refuse. It can also be used for disposal of carcasses of other small animals and as a garbage pit. A more detailed discussion of this method of disposal is given in the March 1948 issue of VETERINARY MEDICINE. This system has become so popular that many of the state colleges now have available complete plans for construction of the pits.

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Poultry Houses and Equipment (Calif. Argic. Exper. Stat. Bul. 476, 1949) may be obtained from the California Agricultural Experiment Station, Berkeley, California. It is well illustrated and contains plans for all types of houses and equipment for all ages of fowl.

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For each dozen eggs produced by a flock of chickens, approximately nine pounds of water are required, plus body requirements, according to data reported by the Illinois Agricultural Experiment Station.

VETERINARY PARASITOLOGY

A. O. FOSTER, B.A., M.A., Sc.D.
Beltsville, Maryland

Ovicides, Larvicides, Repellents and Warbles

For more than a decade, little, if any, basic progress has been made toward a worthy solution of the multi-million-dollar cattle grub problem. Rotenone still holds leadership among the available substances for killing the grubs, the standard cube, or derris, wash is still unsurpassed as an effective formulation, and hand-scrubbing remains the most efficient means of application. There is, moreover, no new approach to the problem of control that offers more promise than area-wide, cooperative effort to achieve maximum destruction of the mature, or nearly mature, grubs in the backs of infested cattle. The principle of community control, based chiefly on a knowledge of the limited flight-range of the flies, is rational, while the method for reducing grub infection is obligatory in the absence of any available, alternative method of achieving the desired result.

This appraisal of the cattle grub problem is intended to be factual rather than critical, for much undeniably difficult work has been done by competent and able investigators. Nevertheless, it is not easy to escape the view that the situation with respect to grubs is in sharp contrast to the trend and pace of events in the broad field of livestock pest control, where the few short years since the war have witnessed notable and unprecedented achievements. Could better progress with grubs be expected from a reorientation in the direction of research, or from more intensive effort along specified lines?

Investigators have considered numerous theoretical approaches to the control of cattle grubs—all presenting special and difficult aspects—including capture or chemical destruction of heel-flies; prevention of, or interference with, oviposition by means of repellents; destruction of eggs on the hairs of cattle; destruction of newly hatched larvae by larvicides before the parasites have been able to penetrate into the hides of the host animals; mass chemotherapeutic destruction of migrating larvae by some suitable agent during the extended period of sojourn within the body of the host; and other possibilities. Unfortunately, none of the commoner chlorinated insecticides (DDT, benzene hexachloride, chlordane, methoxychlor, toxaphene, dichloro-diphenyl-dichloroethane) have proved equal to rotenone in practical grub-killing qualities[1], and moreover, they do not appear to be promising as agents for the destruction of eggs or newly hatched larvae[2]. In spite of these findings and other discouraging aspects of the general problem, the outlook for substantial progress in means and methods of grub control appears to be brighter now than at any time since the development of the derris wash. To a large measure, however, the extent to which progress is made may depend as much on intensified investigation along some of the lines outlined above as on the advantages afforded by the unprecedented developments and discoveries in the field of synthetic insecticides, larvicides, ovicides, and repellents.

Finally, studies of recent date have reemphasized the importance of area-wide control. The advent of high-pressure spraying as a means of applying the insecticide, although it entails some regrettable compromise with efficiency, makes possible a more extensive program than could be undertaken by hand-scrubbing. The application of rotenone to the backs of infested cattle, however, would almost certainly cease to be the preferential method of control, if some other preventive approach were found to be effective and feasible.

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In Hawaii, liver flukes are estimated to infect 80% of the dairy cattle and 50% of the beef animals††. There are approximately 130,000 of the former and 9,000 of the latter on the islands. One group of 419 dairy cows slaughtered on Oahu in 1939 showed 385 (91.8%) with fluky livers.

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The apparent increase in the incidence of tularemia in man may be due to tick transmission of the disease.

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††Alicata, J. E., Studies on Control of the Liver Fluke of Cattle in the Hawaiian Islands. *Amer. Jour. Vet. Res.* 2(3):152-164, 1941.

CLINICAL REPORTS

Delayed Cesarean Section in the Sow

C. R. TUBBS, D.V.M., Cuero, Texas

Veterinarians writing in the journals and trade magazines almost uniformly advise against performing cesarean operations on sows in which the pigs are dead. It is the contention that the mortality is so great that the operation is economically unsound for the owner.

In the past three years we have been presented with six cases in which the pigs had been dead from several hours to several days on which we successfully performed cesarean section. Some were febrile and showed signs of toxicity but all were able to move about and had fairly good physical strength. Two other cases were unable to stand and surgery was not advised on these animals.

The owner is usually instructed to bring the sow to our hospital in a trailer deeply bedded with clean hay. If the weather permits, the entire animal is first washed with a hose. She is then cast on her side in the trailer with the front legs stretched forward and hind legs back. A rope is placed across her chest to keep her flat on her side. In the field we have also used a gate, barn door, or ladder, whichever is the handiest, to good advantage. The flank is shaved, scrubbed with soap and water and then painted with tincture of iodine. The line of incision is first infiltrated subcutaneously with 2½% procaine and then again deeply to the peritoneum. This is all the anesthetic we use, which may not meet the approval of many practitioners.

In our opinion, the fact that no sedative nor general anesthetic is used accounts for the fact that all the sows recover. Actually they struggle very little after they have been tied down for several minutes. Nine dead pigs on which the hair was slipping, were delivered from one sow. Another had only one pig, but it had been dead for four or five days. After the pigs are removed, a ½ oz. bolet of sulfanilamide is placed in the uterus, which is then closed with no. 2 chromic gut and the serous surface dusted with sulfanilamide powder. The peritoneum and muscular layers are sewed with two separate rows of no. 3 chromic gut. The skin is approximated with heavy cotton suture.

Pituitrin is given where the pigs have been dead longer than twelve hours and neoprontosil is given intramuscularly for three to five days. Now that the antihistamines are available, we use these drugs in those animals that are toxic. The sow is kept in clean dry quarters following the operation and the skin stitches are removed in seven to ten days.

We are not so optimistic as to think we shall continue saving all of these cases. However, the favorable results obtained in our first six attempts lead us to believe that a higher percentage will survive than is generally believed and that the operation is economically sound, both to the owner and to the practitioner.

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Reduction of Coxofemoral Luxation In Cattle

K. B. MIDDLETON, D.V.M., Lake Park, Iowa

During the past winter there was an unusual amount of ice formed in lots and barnyards in our section of Iowa. This resulted in many calls regarding broken legs and dislocated hips. I do not propose to discuss the treatment of fractures but to describe a simple method for the reduction of luxations of the hip joint in cattle. These usually occur in cows that are in estrus and may be single or may involve both joints, the cow having literally done the "split".

The first step is to inject 20 cc. of 2% procaine solution epidurally. This relaxes the muscles of the leg which are tense and rigid. The cow is placed in lateral recumbency with the dislocated hip uppermost. A rope is tied to the leg just above the hock, carried down to a half-hitch just above the fetlock, then attached to a block and tackle. The block is attached to a solid anchor slightly above the horizontal level of the uppermost hip and at a point about six inches forward of the hip joint. On traction, this will pull the leg slightly upward and forward. A ten-gallon milk can is placed as a fulcrum under the affected leg and as high up the leg as the udder will permit. The lower leg is drawn as far forward as possible to make room for the milk can. Gentle traction is now placed on the leg by pulling up the block and tackle and at the same time depressing the leg over the milk can. If necessary, move the leg forward and with the forces as described applied in the three directions, work the head of the femur until it slips into the acetabulum. If it is a bilateral luxation,

the cow is rolled on the other side and the operation repeated.

After-care consists of keeping the cow confined in a small box stall and off the ice. If in estrum the cow should be inseminated artificially provided she is to be retained in the herd. Unless she is a valuable cow I usually recommend slaughter after conditioning. Luxation tends to recur in these animals under ordinary herd management and at calving.

I have reduced four cases this last winter, one a bilateral dislocation, using the method described, with satisfactory results.

K. B. MIDDLETON, D.V.M.
Lake Park, Iowa

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Lipoma in an Aged Dog

EDWIN E. EPSTEIN, D.V.M., Sedalia, Missouri

On Sunday, November 27, 1949, the writer was called to perform euthanasia on an aged English Setter. The animal had a huge lipoma on the right shoulder which extended, in its long dimension, approximately eight inches. The dog had been examined about a year previously when the tumor was smaller, at which time the owner had been advised by the attending veterinarian against surgical removal because of the danger of shock, and probable recurrence.

The dog seemed to be in good health and condition. The owner was very upset about having the animal put to death. He was advised that with permission anesthesia would be administered, and an attempt made to remove the mass; if serious difficulties were encountered, euthanasia would be performed.

The animal was given enough somnopentyl intravenously to effect surgical anesthesia and the area clipped, shaved, and a skin disinfectant applied to the operative field. A 12 inch incision was made over the center and the gloved hand inserted in the skin opening to palpate and explore the extremities of the mass. The lipoma did not seem to be securely attached to the underlying fascia and tissue, and much to the writer's surprise peeled out quite easily with little loss of blood. There were no blood vessels to ligate. It was necessary to remove a strip of skin three inches wide and as long as the original incision to effect proper wound closure.

A 5 cc. dose of picrotoxin was given intravenously to alleviate shock symptoms noted as white, bloodless conjunctiva and buccal mucosa. The dog was discharged immediately as hospital facilities were limited, and the owner instructed in the care. A guarded prognosis was given. The tumor removed filled a gallon bucket and weighed about 20 pounds.

The owner called next day to advise that the animal had recovered from the anesthesia very satisfactorily and was eating. Except for local tenderness and a moderate discharge from the drainage opening, the dog made uneventful recovery.

In conclusion, some word might be said on doctor-client relationship. With all respect to the small animal specialist who had previously examined the animal, he had left the impression that he was not interested in the dog.

Dog owners are quick to notice any apparent lack of interest in the ailments, real or imaginary, of their beloved animals. It would behoove many of us to take more interest in our clients and their pets and it will pay dividends in increased practice and satisfied clients.

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Unusual Bovine Surgery

R. T. STAPLETON, D.V.M., Fayetteville, N. C.

On July 5, 1949, the writer was called to see a dairy cow in which four inches of glass tubing had broken off in the vagina the night before. The cow had jumped during artificial insemination breaking the insemination tube. The inseminator advised the owner that if the tube had not passed by the next day to call a veterinarian.

This cow on examination showed no rise in temperature and only slight straining. Appetite was poor. Vaginal examination revealed no evidence of any tubing and it was suspected that it was lodged in the uterus.

The cow was prepared by giving a sedative and was cast on the left side. An incision was made in the right flank as for cesarean section. On entering the abdominal cavity an immediate examination of the horns and body of the uterus was made, but the tube was not in the uterus. After an extensive search of the abdominal cavity, the tube was found lying loose on top of the bladder. This was removed and 250 cc. of sulmet placed in the cavity.

The incision was closed with catgut (peritoneum and muscles); with wire for skin sutures. The latter were removed in a week.

The cow showed no temperature rise and was eating the next day. One million units of penicillin were given at this time as a precaution. The cow came in heat at the next regular heat period.

It was concluded that the lay inseminator completely missed the cervix and rammed the glass tube through the vaginal wall.

ABSTRACTS OF LITERATURE

Cell Count in Bovine Mastitis

Research work to determine the correlation between high cell count of milk and mastitis is reported by the authors[10]. Some earlier experimental work had suggested that the cell count of milk is the most reliable criterion of mammary inflammation. Furthermore, it has been shown that in many of these inflammatory conditions, none of the organisms commonly associated with mastitis are present in milk samples.

In the work reported, extending over a period of three years, the foremilk of a large number of quarters was examined at weekly intervals. Estimation of cell count was made by the Breed's smear method. Postmortem examination was conducted at slaughter of these animals. Bacteriological cultures were made and tissue prepared for histological examination. The value of antemortem cell count and bacteriological culture was then assessed in the light of histological findings.

The results obtained provide definite evidence that high cell count in the foremilk is almost invariably associated with inflammatory changes in the udder as judged by histological examination. A persistent cell count of 100,000 per ml. indicates inflammatory changes but this figure must not be taken as pathognomonic of mastitis. In interpreting results, consideration must be given factors that might influence the cell count or irregularities.

The authors conclude that : "(1) More than half of the early cases of mastitis escape detection if laboratory diagnosis is based solely on the results of culture tests of the milk, whereas only about 5% of these cases escape detection if the cell count test is employed. (2) Mastitis may be present as shown both by antemortem cell count of the milk and by postmortem histological examination, although none of the typical mastitis organisms or other pathogens can be found either by culture of the milk or tissue." The fact that 39% of the histologically positive mastitis quarters gave negative results on cultural tests suggests the possibility that other and as yet unknown etiological factors or agents are operative during the early stages of mastitis.

10. McFarlane, D., Blackburn, P. S., Malcolm, J. F., and Wilson, A. L., A Comparison of Antemortem and Postmortem Findings in Bovine Mastitis. *Vet. Rec.*, 61:807 (Dec. 3), 1949.

Leptospirosis of the Dog

At the Veterinary Institute of the University Göttingen, Professor Schindler[9] has investigated canine diseases caused by *Leptospira canicola*. Among the cases brought to the clinic during the winter season 1948-49 from the Göttingen area, serological investigations ascertained the diagnosis in 28 dogs. In five of them, the microorganism could be detected in the urine with the help of a dark-field microscope. The investigator discovered the interesting fact that the acceleration of the sedimentation of blood corpuscles is an early and constant symptom of acute and chronic, but not of the latent form of leptospirosis of the dog. However, since other diseases show similar symptoms, this finding must be considered together with other factors. If the sedimentation rate of a suspected animal is normal, chronic, or acute, leptospirosis is to be excluded. Eight of 12 of the sick dogs responded to administration of penicillin; the required dosage being greater in advanced cases. Blood transfusions proved a valuable adjunct to the penicillin therapy in five cases. Such transfusions were particularly valuable for overcoming exsiccosis which often accompanies leptospirosis. A definite diagnosis of the disease in the early stage is of great significance for the prevention of its spreading to human beings and for successful treatment. It must be based primarily on the determination of antibodies and the morbific agent. —G. L.

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Obstruction in the Small Colon of Horses May Be Treated Manually

Often the small colon is so closed up that the obstruction does not yield to conservative therapy. In such cases, Doctor Behrens of the Veterinary College of Hannover[4], recommends opening the abdominal cavity (flank incision for males, vagina incision for mares) and manually breaking up the accumulated feces. Two cases are cited in which complete recovery occurred within ten days.—G.L.

[9]Schindler, R., Untersuchungen über die Leptospirose des Hundes. (Investigations about Leptospirosis of the Dog.) *Deut. tierärztl. Wochenschr.*, 56:241-245 (1949).

[4]Behrens, E., Manuelle Zerkleinerung von Verstopfungen im kleinen Kolon nach Laparatomie. (Breaking Up Manually Obstructions in the Small Colon, Following Laparatomy.) *Deut. tierärztl. Wochenschr.*, 56:259-260 (1949).

BOOK REVIEWS

Books reviewed in this department and any others, if available, may be obtained by remitting the published price to the Book Department, Veterinary Medicine, Suite 803 Livestock Exchange Building, Kansas City 15, Missouri.

ANIMAL SANITATION AND DISEASE CONTROL, by *R. R. Dykstra,* D.V.M., dean emeritus, School of Veterinary Medicine, Kansas State College, Manhattan. Cloth bound. Second edition. 792 pages. 183 illustrations. The Interstate Press, Danville, Ill., publishers, 1949.—Price $3.50.

This book is essentially a treatise on how to keep animals healthy. It has been prepared for the teacher and student in animal husbandry and the sanitarian, but will prove of value to veterinary practitioners. The appearance of this enlarged edition is timely and should pace the trend of consciousness of all those interested in the production and conservation of meat-producing animals.

The subject matter is more than that implied in the title of the book, and is presented in a brief concise style. The theme of the discussion is the most efficient livestock management practices necessary for profitable production of animal food products. The importance of all elements of cleanliness to accomplish economical production and for all disease prevention is emphasized. Manure removal, scrubbing, drainage, application of disinfectants and sprays, grooming, care of equipment, isolation and quarantine, the vital importance of a good water supply, adequate feeding and a large number of other considerations are outlined in the light of animal economy and disease control.

Text material dealing with disease conditions is presented as some brief factual information which will serve to point up the necessity for vigilance on the part of caretakers to know when professional service is required. The author repeatedly makes the firm assertion that the purpose is not to provide a text for the treatment of animal diseases ". . . . by those lacking formal professional veterinary training. The disease problem is far too complex for anything of this nature to be attempted and, therefore, the matter of treatment has been purposely avoided." Emphasis on the value of the training and skill of veterinary practitioners to the animal husbandryman is frequently suggested. Use of trained veterinarians is shown to be a practical and economical means for the control and treatment of anomalies of farm animals. Thus, "Therefore, any tampering with these organs is likely to be disastrous. The highly trained veterinarian should be consulted." "The veterinarian is the keystone supporting the arch upon which rests the entire burden of all those factors concerned with the preservation of animal health."

The book is divided into 11 parts, entitled: Some Animal Health Factors; Some Animal Disease Factors; Some Methods of Disease Control; Infections and Their Handling; External and Internal Parasites and Their Control; Non-Infectious, Sporadic Ailments; Infectious and Communicable Ailments of Farm Animals; Some Infectious and Communicable Ailments of Barnyard Fowl; Parasites and Disease; Miscellaneous Information; and Livestock Sanitary Bureaus, Boards and Commissions, and the Veterinarian. Material under each part is divided into chapters. The style of side heads assists in locating references. Table of contents and index are thoroughly prepared and exhaustive. Running references in the text material cite sources of more detailed information.

It is the opinion of the reviewer that wide distribution of this book among livestock growers will make a material contribution to the prevention and control of animal diseases.

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MAY'S MANUAL OF DISEASES OF THE EYE, edited by *Charles A. Perera,* M. D., 20th edition. 485 pages, 378 illustrations, including 32 plates, with 93 colored figures. Williams & Wilkins Co., Baltimore, Md., publishers, 1949.—Price $5.00.

The veterinarian who is desirous of learning more of ophthalmology should most certainly reserve a place in his library for this text. It is a concise, practical and systematic manual intended for use by the medical student and general medical practitioner, but is well adaptable, for the most part, to veterinary use.

The twentieth edition of May's Manual has been completely revised and brought up to date by Doctor Perera, yet its size has not been increased, complying with Doctor May's original desire to make his manual as concise and practical as possible, with the elimination of

details which would be of value only to the specialist.

Of especial interest to the veterinary ophthalmologist should be the sections pertaining to the external examination of the eye, use of fluorescein stain in the diagnosis of corneal abrasions, and the use of the binocular loupe or magnifier. The sections on diseases of the cornea and conjunctiva, with accompanying illustrative plates, will of course receive the most attention from the veterinarian reviewing this book, because, from the practical aspect, it is with these two structures that we are most concerned. Those interested in ocular surgery will find many of the operations described in the text readily adaptable to the small animal patient.

Probably that section on ocular therapeutics, however, should receive our most considered study, since the uses and contraindications for the many drugs we are employing in our practice are interpreted in credible manner; as well as the formula of a number of prescriptions which can be utilized.

Although those parts concerned with the subjective or functional examination and general optical principles can be discounted for our use, it remains that the fundamental facts of ophthalmology outlined, make the book, as a whole, a valuable reference for veterinary practioners.—W. G. Magrane, D.V.M.

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FEEDING OUR DOGS, by *Leon F. Whitney,* D.V.M. 243 pages. D. Van Nostrand Co., Inc., New York, publishers, 1949.—Price $3.50.

In a magazine article published 16 years ago, Doctor Whitney, then a recognized geneticist and a successful dog breeder, advocated canine rations resembling those now accorded scientific approval. In 1934, that was just plain heresy to most writers on the subject of feeding dogs and it was condemned roundly. However, economics favored the author. The country was near the bottom of the great industrial depression of the '30's. The Whitney formula, which was developed as a result of a vast experience with dogs and keen powers of observation, was less expensive to prepare than the rations in common use. It caught the popular fancy and the great progress that has since been made in canine nutrition was on the march.

Feeding Our Dogs is a timely, comprehensive, authoritative, and an eminently practical work. It is just what one would expect from an author thoroughly grounded in genetics and veterinary medicine, who has bred and raised more than 8,000 dogs of his own, conducts a large veterinary practice, where daily he sees the ills of poor feeding, is entirely familiar with all research in canine nutrition, and is at the same time an experienced and successful writer in both popular and scientific magazines.

Unfortunately the publisher has added an unwarranted subtitle to the dust jacket— "A practical, scientific and economical method of insuring (assuring) your dog's health." Of course no ration will protect a dog from infection or accidents, nor is there anything in the text to support such a claim.

To prepare the reader for what is to follow, the author begins his treatise with nine "feeding don'ts", that in some measure illustrate his approach to the subject:

1. Don't waste money. Feed dogs well by taking thought.

2. Don't try to make a human being out of your dog. Because we like certain foods is not a valid reason why dogs must have them.

3. Don't harken to self-appointed "authorities." These "experts" may be known by their self-assurance and dogmatic statements.

4. Don't think because one event follows another that the first necessarily causes the second. Superstition is based upon such nonsense.

5. Don't start with preconceived opinions that dogs can't digest certain food substances. That is conjecture. Wait for the evidence.

6. Don't regard any dog food as a "filler." Every ingredient in a dog food should be a nutritional element and have a purpose.

7. Don't evaluate a dog food by how readily a dog eats it. Usually a dog balks at a new food until he becomes acutely hungry.

8. Don't think all dog food manufacturers lack integrity. Various commercial dog foods are complete in every known nutritional requirement.

9. Don't ever believe there is only one correct way to feed dogs. There is no one best way to feed them.

This work will not disappoint the purchaser. —D. M. C.

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The antibiotic, streptomycin, has been quite thoroughly evaluated by clinical data in the handling of human tuberculosis. It is more effective in acute pulmonary tuberculosis than in the chronic form. Large doses are more effective than small, but toxic reactions are frequent with the large doses. The mode of action of the antibiotic is not known.

VETERINARY ITEMS OF INTEREST

New Insecticides Recommended

The new insecticides, toxaphene and lindane, are recommended in a news release from the USDA.

Sprays containing 0.5% toxaphene are suggested for the control of ticks, lice, and horn-flies on all livestock except dairy cows. Lice on sheep and goats and the sheep tick can be controlled with dips containing 0.1% toxaphene.

Lindane (pure gamma isomer of BHC) is also recommended as a spray (.03%) for the control of lice on dairy cows. (See *Vet. Med.*, Dec., 1949.)

Both of these chemicals must be used cautiously and concentration of sprays and dips must not exceed that recommended.

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Vitamin Content of Milk

The vitamin A content of milk is subject to extremes of variation as influenced by season and food intake. Vitamin C is largely lost in processing and storage.

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Chloromycetin has been shown to be effective in treating canker sores of early syphilis. The antibiotic is given by mouth for six to eight days.—*S.N.L.*

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Advise parents to keep children away from sick pets. Cases are on record where unknowing infection with diseases and parasites has occurred through carelessness and neglect.

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A detailed study of 200 cows of the Beltsville, Md., BAI experimental herd showed that there is no correlation between production and the size of milk veins in dairy cows.

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One of the larger groups of Army animals currently under supervision of the Veterinary Corps is a unit of dogs on guard duty in Japan.

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Artificial insemination of dairy cows in England, begun four years ago, now is said to be increasing average productivity.

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Expressed on the basis of bodyweight, vitamin A requirements are about the same for widely divergent species of farm livestock.

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The BAE report estimates that the 1949 fall pig crop is 10% larger than in 1948.

A hemophilia-like disease in Aleutian mink is reported by Dr. T. T. Chaddock (*American Fur Breeder*, 22:26 [Oct.], 1949). Fatal cases of hemorrhage are cited in which exhaustive postmortem examination and serological studies failed to demonstrate bacterial or virus infection. Where outcrossing has been practiced recently, the incidence of the condition appears to be reduced.

A discussion of hemostatic agents employed following minor surgery on mink is presented.

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A contest for turkey-herding dogs was a new feature of the Pacific Coast Turkey Exhibit at McMinnville. The dogs were required to herd five turkeys into a small pen and back to the point of first release.—*Poultry Packer*, Nov. 26, 1949.

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Field reports indicate that dipping or thorough spraying of dogs with 0.1% gamma isomer of B.H.C. will kill any species of ticks which may be attached to the skin and will protect against attachment by ticks for approximately a week.

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In 1948 the Army assisted in processing 8,000 mules shipped into Greece. More than 5,000 were processed for shipment during 1949.

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Frequently recurring hunger, easily satisfied and quickly returning, suggests a pathological accumulation of hair in the stomach of cats.

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- **Norcalcinate.** U. S. Patent No. 2,043,211. Contains calcium aluminogluconate, 27.3%. For uncomplicated **milk fever.**

- **Norcalciphos.** U. S. Patent No. 2,144,830. Contains calcium aluminogluconate, calcium glycerophosphate (total calcium equivalent to 16.6% calcium aluminogluconate); magnesium chloride, dextrose, 20%. For milk fever complicated with acetonemia.

- **Norcalcidex.** U. S. Patent No. 2,043,211. Contains calcium aluminogluconate, 27.3%; dextrose, 20%. For milk fever and calcium and glucose deficiencies.

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